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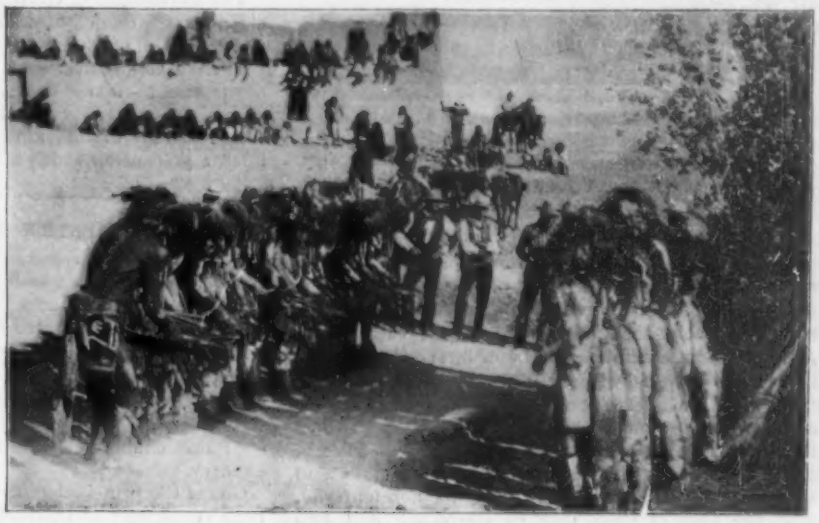
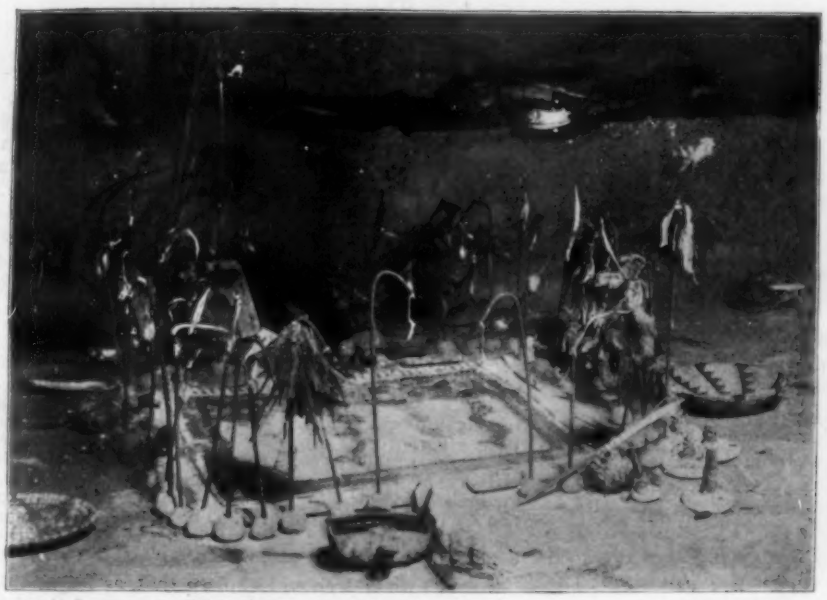
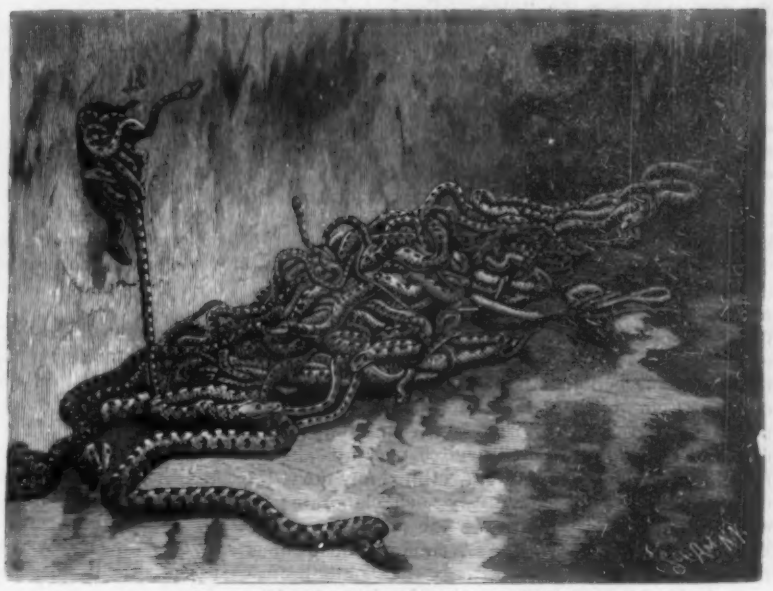
Moki Snake Dance—Antelope Priests Leaving Kiva.



Moki Indian Snake Dance.



Sacred Altar, Antelope Kiva.



Mass of Snakes After Ceremony of Washing.

Photographs copyrighted, 1898, by G. Wharton James.

Kopeli, Chief Snake Priest, Walpi.

Moki Towns on Second or Middle Mesa.

THE SNAKE DANCE OF THE MOKIS.—I.—[See page 408.]

Scientific American.

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SECRECY IN YACHT CONSTRUCTION.

Now that the "Columbia" is launched and the "Shamrock" is practically completed, an accurate description, such as will be found on another page, of the method of construction adopted in the case of the American boat cannot fail to be of interest; moreover, it can be given without any fear of disclosing "wrinkles" whereby those responsible for the construction of "Shamrock" may benefit. And just here it may be well to say that so exact is the science of yacht designing, so much is it a matter of careful theoretical calculation of form, weights and material, that the idea of such men as Herreshoff and Fife "chopping and changing" their plans because of some glimmering of what the "other fellow" is doing, is—well, it is simply unthinkable. Much alike as the two yachts will be to the unpracticed eye, they will represent the latest development of two distinct schools of design as represented by the distinguished architects above named. If the two yachts resemble each other closely, it will be because, by an independent process of elimination and addition, each designer has been drawing closer and closer to the ideal racing machine, profiting each year alike by the failures and successes of his previous boats.

There is no nobler sport than that of yacht racing, none that is by common consent more free from the taint of professionalism. Hence there are many yachtsmen who will hail with delight the day when the present extreme methods of secrecy, such as are characterizing the construction of "Shamrock" and in a lesser degree "Columbia," will be abolished. In the first place, the secrecy is never successfully maintained, and even if it had been, the English challenger upon its arrival in this country has never exhibited any novelties of construction that would justify such elaborate precautions. The novelties (if we except, perhaps, the model of "Valkyrie" II.) have been more conspicuous in the American yacht, as witness the Tobin bronze underbody of "Vigilant," and the aluminum topsides and deck construction of "Defender." The broad and shallow American sloop and the deep and narrow English cutter have merged into the Anglo-American broad and deep cutter-sloop, with little to distinguish challenger from defender in materials and workmanship. Surely, then, we have reached a point in the history of international yacht racing when we can dispense with "petticoat" launchings, private detectives, and all similar incumbrances of a noble sport.

COMPARISON OF ELECTRIC AND STOVE HEATING ON STREET CARS.

A specialist from one of our leading technical institutes informs us that in an early day of electric street traction, and before electrical engineering had resolved itself into a separate profession, he was called in by a street railway company to report on the merits of an electrical heater for warming the cars of the company. Careful tests showed that each heater consumed two electrical horse power, and as it required four heaters, or eight electrical horse power, to warm properly each car, the company was advised that in the state of the art at that day, electrical heating would be uneconomical. The subsequent extensive growth of the railway system in question, the concentration of its power plant in large central stations, improved methods of steam generation and expansion, and more scientific construction of generators and heaters, have so far modified the situation since that first report was made that to-day the same company is not only heating its cars exclusively by electricity, but doing it for less cost than they could be heated by coal stoves. At the same time, notwithstanding the great advances which have been made in the generation and use of electricity, it is evident that the superior economy of electric heating in this particular case must be largely due to local and special causes; and an examination of the books of the company showed that while the cost per electrical horse power had greatly decreased, the economy resulted chiefly from conditions peculiar to street car warming. Thus the mere keeping of the stoves in repair, and cleaning and lighting them, necessitated the employment of a surprisingly large force of men. Then, again, during the period of moderate temperature at the commencement and close of the winter, the stoves would frequently be lighted for brief periods in the morning and evening, or at the request of particular passengers during the day, and this would necessitate the consumption of a whole stoveful of fuel, where, with electric heating, the current could be switched on and off at will, and maintained for the exact period of time during which there was a call for it.

The advantages of electric heating resulting from its cleanliness, absence of odor, and ease of control are familiar to all of us, but that it should have shown a positive economy over coal will come in the nature of a surprise to many of our readers. The result emphasizes the necessity of making all comparative estimates of cost of this kind on the broadest possible lines, a precaution which is too frequently neglected.

AN INVENTION SORELY NEEDED.

As an incidental result of our having become one of the colonizing powers, with four dependencies—Puerto Rico, Hawaii, Guam, and the Philippines—and Cuba likely to become the fifth, our inventors are already called on to cope with a considerable number of entirely new problems, some of them springing from conditions very foreign to anything known to the Father Republic, if we may coin that term—for surely "Uncle Sam" can scarcely be associated with a mother country.

One of the principal and most immediate needs of the hour, especially at this moment in Luzon, is some effective method whereby wood may be rendered absolutely impervious to the attacks of the various species or allies of the genus Termites—the white ants. Writing to our State Department, in 1893, the then United States consul at Amoy, China, Dr. Edward Bedloe, said:

"A fortune lies in store for the man who will discover some process for cheaply making wood proof against white ants. These pests are the curse of existence in Amoy and every other tropical or sub-tropical city. Their voracity is incredible. They ate the framework of a new door in this consulate in three weeks. In the same period they almost consumed a large and handsome cabinet in the court-room, and a heavy pine settee in the ante-room. Their work is invisible. They attack the wood from a mere point, through which they bore to the interior, and there eat everything until only a shell or film remains. Wood which will successfully resist these insect pests must be thoroughly charged with some powerful chemical, both poisonous and non-evaporable. A solution of corrosive sublimate, chloride of zinc, arsenic, or antimony would seem to meet the want. But how to force these into the fibers, until the latter are saturated, and to do so at a merely fractional cost of the wood itself, is the problem that confronts the inventor. The American genius is so prolific in invention and discovery, that I feel assured the problem will be satisfactorily solved."

Six years have passed, and the consul's faith in the genius of American inventors has not yet been vindicated, while the great need of some such process as he suggests has yearly grown greater as clothes-wearing Europeans have attempted to penetrate deeper and deeper into tropic wildernesses. A soldier-correspondent of one of our Western dailies graphically writes from Manila, after having returned from one of the recent Aguinaldo-chasing raids:

"These Tagals are as elusive and annoying as wasps, and not much more dangerous, if you can only catch them. For my part, I consider the white ants much more invincible. A fellow feels pretty bad after a three days' tramp in this fern-house climate to get back to camp and clean clothes, only to find that a colony of white ants have burrowed into his chest and that all his belongings, not made of metal or glass, have been reduced to a rather fine powder."

Now that this white ant scourge is about to make itself felt upon the American colonist, we may look for something more than the stolid acquiescence with which its ravages have been so long received. We have here a field for invention which is decidedly promising. The income to be derived from a successful system of ant-proofing could not fail to be very considerable, and the successful inventor would have the satisfaction of conferring a lasting boon upon this and many another pest-ridden corner of the earth.

PETROLEUM FUEL BETTER THAN COALING STATIONS.

We are in receipt of a letter from a naval attaché in Europe who has been for many years identified with this branch of the service, from which we quote the following: "I note in the United States papers that the Bureau of Equipment of the Navy Department is making large deposits of coal in various quarters of the world, and that experiments are being continued with someone's method of coaling ships at sea. I wish your paper would protest against this and call attention to the fact that the same amount of money devoted to perfecting furnaces for consuming liquid fuel would lead to much more practical results. Ships can never be coaled at sea, except in a dead calm, whereas, with liquid fuel, you can take the tank ship in tow and steam in the teeth of a gale while you pump your fuel on board through a hose. In time of war the tank ships can meet the fleet at any given latitude and longitude in the middle of the ocean. Coaling stations are expensive to keep up, the coal deteriorates, and England has all the good places anyhow."

We are heartily in favor of generous appropriations for liquid fuel experiments, especially as many of the latest battleships building for foreign navies are designed to carry oil in their double bottoms and use it in conjunction with coal in their boilers. At the same time the Navy Department has to deal with the situation as it stands, and for many a long year to come we are certainly committed to coal as the fuel of our warships. The superior advantages of petroleum over coal are so many and obvious that it will unquestionably form a large part of the fuel supply of armored vessels in the near future; but until our own ships are fitted for its use, we think that coal supply stations are a positive necessity, particularly in view of the recent territorial enlargement of our republic.

THE LIQUID AIR FALLACY.

BY HENRY MORTON, PH.D., LL.D., SC.D., PRESIDENT STEVENS INSTITUTE OF TECHNOLOGY.

Having examined a pamphlet entitled, "Liquid Air. Perpetual Motion at Last. Tripler's Surplusage Explained." By H. Gaylord Wilshire, Los Angeles, Cal., 1899, I will try in a brief and popular manner to point out what I conceive to be the essential fallacy of the position taken by the author of this pamphlet.

To the ordinary reader it is not easy either to perceive this fallacy or, in fact, to get any very clear notion of the actual conditions of the problem which the author proposes to solve and explain, there being a remarkable mixture of true and incorrect statements and assumptions which are directly contrary to fact. But, fortunately, at the very end of the article, there is given a note which contains in itself a fairly clear and concise expression of the fundamental position of the author, which thus can be without much difficulty appreciated, and can therefore be answered without too many words and too much elaborate explanation. The note to which I refer reads as follows:

"NOTE.—Theoretically the energy developed by expansion of a given weight of liquid air in *A* will liquefy an equal weight of air in *B* during a definite time. The process toward liquefaction involves overcoming resistance to compression of air in *B*. If this resistance is reduced by cooling with water, then more air in *B* would be liquefied in a given time than is at the same time expanded in *A*. The difference between these weights of air is the surplusage effected by the cooling of the water. (See diagram.)"

To start with, I should explain that, as far as this note is concerned, the only important parts of the diagram are two cylinders, *A* and *B*, having pistons in each, so connected that an upward motion of the piston in *A* involves a downward motion of the piston in *B*, developing equal displacements, so that, for example, if the contents of the cylinder, *A*, doubled in volume, the contents in the cylinder, *B*, would be correspondingly reduced.

This being premised to render unnecessary the reproduction of this diagram, I think there is no difficulty whatever in understanding the position taken by the author of this note. He evidently intends to say that, theoretically, the energy developed by the expansion of a given weight of liquid air in *A* will liquefy an equal weight of air in *B* during a definite time, without the aid of cooling water, which he describes as being subsequently applied and as being a source of an increased effect.

Now, this statement is absolutely incorrect. The expansion of a given weight of liquid air in *A*, so far from developing a power capable of liquefying an equal weight of air in *B*, would be absolutely incapable of liquefying a single drop of air in *B*. What would really happen is this: The energy developed by the expansion of a given weight of liquid air in *A* would develop an equivalent amount of energy in *B*, theoretically, in two forms; in the first place, as heat, or, in other words, the air in *B* would be very highly heated by the act of compression; in the second place, another portion of energy would be developed in *B*, by reason of the increased pressure or tension brought about in the air filling *B* by the afore-mentioned compression. Even if no heat at all were developed in *B*, and it remained at the atmospheric temperature during this compression, this would not convert it into liquid air, for it is, of course, a well-known fact that no amount of pressure will liquefy air until its temperature has been reduced to what is known as the critical temperature, which is 220° Fah. below zero. Still less, therefore, would it be possible to liquefy this air while leaving in it the heat of compression, by reason of which its temperature would be greatly

raised; therefore, it would be necessary, as a very first step in any process of liquefying air, to remove this heat of compression, and this is exactly what is done by Mr. Tripler, or anybody else who carries on a process of producing liquid air. By means of appropriate condensers, the air, as it is being compressed, is cooled so that when it reaches the final pressure, which is 2,500 pounds to the square inch, it is at the temperature of the surrounding air, or rather of the water used as a cooling material.

It should be noticed at this point that in so removing the heat from the air, said air has been deprived of a considerable amount of the energy transferred to it from the expansion of the liquid air in the cylinder, *A*. In other words, this first action or step of cooling has thrown away or removed from the apparatus a portion of the energy developed in it. If we could compress the air and retain the heat in it with no loss, then we might expect to recover from said compressed air so heated an amount of energy equal to that which had been used in compressing it; but if we have cooled the air, we have removed heat from it (which may be measured by the amount of water used and the temperature added to said water), we have taken away a portion of its contained energy and its power of doing work.

In several points where this matter is referred to by the author of this pamphlet, he seems to have made the strange mistake of transferring what we might call a debit item to the credit side of an account, and estimated as a gain what is in fact a loss.

Now, then, let us assume that by vaporizing air in the cylinder, *A*, or by any other means, we have developed energy which has been applied to compressing air in the cylinder, *B*, and that we have removed or thrown away a portion of that energy by cooling the compressed air down to an atmospheric or water temperature; what more must we do to obtain any liquid air? This is not hard to answer, because we need only to refer to what is done by Mr. Tripler, Mr. Linde, or anyone else who is carrying on substantially the same process; that is, we allow the highly compressed and cooled air to escape under certain conditions, whereby its expansion in so escaping reduces its temperature and finally brings it to a point at which a portion of the air becomes liquid. It is obvious, however, that in so doing we must throw away or allow to escape a very large proportion of the compressed air, which as far as it went represented what was left of the energy developed by the expansion of the liquid air in the cylinder, *A*.

As a matter of fact, from data which I know to be reliable, in the apparatus used by Mr. Tripler, the amount of air obtained in the form of a liquid represents only about one-twentieth of the compressed air which he allows to escape or expand at this point of the operation. According to certain publications by Linde, in Germany, it would appear that he has done about the same thing, and gets about one-twentieth of the compressed air in the form of liquid air. Either of these figures, however, shows the perfect absurdity of the statement which I have quoted from the note, since it makes it obvious that only a very small fraction of the liquid air used in developing energy by expansion in the cylinder, *A*, is recovered or reproduced or could be recovered or reproduced from the compressed air in the cylinder, *B*, even with the aid of sufficient cooling water to abstract all the heat of compression.

If this state of affairs is clearly understood, as I think it may be by anyone reading the above remarks, the utter fallacy of pretty much all that is stated in this pamphlet will be manifest. Thus, on page 6 of this pamphlet, we find as follows:

"However, there is an outside force mentioned casually by Tripler in all his statements, but which is not dwelt upon by either him or the 'scientists' as being capable of furnishing the looked-for surplus. It is the water used to cool the air heated by compression in his condenser.'

As I have above shown, however, the water used to cool the air, so far from increasing the amount of energy present in the air which is to be liquefied in consequence of the work expended upon it by the compressing agent, is simply a means of removing and wasting such energy, and therefore obviously is as far as possible from accounting for any such imaginary "surplus"; or, in other words, there would be a great deal more energy or capacity for doing work in compressed air if the cooling water was not applied and such compressed air was used in its heated condition.

It would be tedious and I think quite useless, after what I have said, to quote and further point out the fallacy of succeeding statements in this pamphlet in which this same idea is developed in various forms. The fallacy is obvious at once to anyone realizing what is the actual or true condition existing when air is compressed by the application of force and what conditions must exist before any liquid air can be produced.

In my article on the liquid air fallacy, published in your issue of April 22, 1899, I pointed out what were the true conditions as regards the possible utilization of atmospheric heat in the production of motive power or the doing of work, and I there draw attention to the fact that for such utilization it was necessary, not only to have a certain temperature in the air, but a notably lower temperature in an abundant supply of water, and that the amount of energy derivable was measured simply by the amount of heat transferred from the air to the water. In that case I confined my attention to the calculation of the amount of air at a temperature of say 70°, which must be supplied to the imagined machine if an unlimited supply of water at 50° was also available, and the result so obtained showed the impracticability of such a method so fully that it seemed unnecessary to take any account of the quantity and cost of water. If, however, we choose to consider this, it is easy to calculate, accepting the data given in this pamphlet, what amount of water would be needed, and from such calculation we find that this amount would be very large, so that if the water cost anything, which as a matter of fact it invariably does, it would be a serious element in the expense of a process and would make such process still more impracticable than it is shown to be by the mere consideration of the amount of warm air required.

I refer to this only as showing that in my original article there was no oversight or failure to appreciate the true action of cooling water as an absolutely essential element in any plan or process for the obtaining of power from atmospheric temperature. I also pointed out in that article that if we expected to get power free from nature the cooling effect of the water as well as the heating effect of the atmosphere must be obtained as a free gift, and that if the cold or cooling effect was in any sense manufactured, or if a greater degree of coldness or lowering of temperature beyond that which nature would supply in a stream of cold water was introduced as an element in the problem, then the cost of producing such additional low temperature or cold would be fully equal, and as a matter of experience in the case of liquid air, enormously in excess of any power which could be had by reason of its use. In other words, that if it was too costly to operate the machine between the limits of the temperature supplied, let us say atmospheric air at 70° and cooling water at 50°, this cost would be vastly greater if we attempted to operate a machine by employing the temperature of the atmosphere as a source of heat and liquid air or any other artificially cooled substance as the cooling agent. It would be then, as I said, exactly analogous to an attempt to add to the efficiency of a head of water by digging a well into which we could run the escaping water but out of which we should be obliged to pump such escaping water in order to keep the well empty and thus avail ourselves of the head or extra pressure developed by its depth.

The pamphlet referred to contains in addition a great many less important errors and fallacious arguments, but I think I have gone far enough to show its utter unreliability and to save any of the readers of the SCIENTIFIC AMERICAN from being misled by its extraordinary assertions and unsupported statements.

THE HEAVENS IN JULY.

BY GARRETT P. SERVISS.

There is no time when the stars exercise a greater charm than in midsummer. After a near-by sun has stricken us with his fiercest rays, thousands of distant suns, glimmering through the dark, bring a contrasting sense of coolness and relief. The spirit of romance has always recognized the influence of starlight on a summer night, although psychologists, as such, appear not to have noted it. Yet the spell exists, and millions experience its effects without undertaking to account for them. But there is nothing mysterious in the phenomenon, and the astrologers can derive from it no support for their superstition. It is simply an expression of the innate poetry of humanity. Those lines of Longfellow's,

"Stars of the summer night,
Far in yon azure deeps,"

may awaken for the astronomer thoughts different from those that arise in the mind of the unscientific reader, but the impression on both is substantially the same—a half-dreaming consciousness of vastness, sublimity, and superhuman power, set over against a sense of the insignificance of the earth, and mingled with a dim perception of beauty transcending terrestrial standards. Savages and civilized men alike yield to this fascination of the starry heavens, and it is capable of subduing, for a while, the most untamed spirits.

The stars and constellations are most beautiful in the absence of the moon, and this year the opening evenings of July will be free from the presence of that "lesser light" which rules, and sometimes, for the astronomer at least, mars the night.

At 10:30 P. M. on July 1, at 9:30 P. M. on July 15, and at 8:30 P. M. on July 31 the principal attractions of the starlit firmament will be arrayed as here described. Overhead shines the constellation Hercules, recognizable by a quadrilateral figure formed by four of its chief stars, and lying between the beautiful circlet of the Northern Crown on the west and the brilliant Vega, with its two little attendants forming a minute triangle, on the east. Directly north of Hercules is the head of Draco, marked by a conspicuous diamond figure of stars. Below the head of Draco stands the Lesser Bear, Ursa Minor, erect on the end of his long tail which terminates in the Pole Star. West of the Northern Crown is Boötes, the giant huntsman, with his great lone brilliant Arcturus blazing on his garter. North of Boötes appears Ursa Major with the Great Dipper descending, bowl downward, toward the northwestern horizon. The broad constellation of Virgo spreads over the lower part of the western sky, still resplendent with the glory of Jupiter's presence within its borders. Sprawling across the south, and touching the horizon, is Scorpio, the center of the constellation made conspicuous by the fiery red Antares, one of the most remarkable of stars. East of the meridian the sky is spanned from the northern to the southern horizon by the most brilliant portion of the Milky Way. Starting under the Pole Star it passes through the zigzag figure of Cassiopeia's Chair, and higher up, opposite Vega, seems to bear the Northern Cross afloat in its nebulous stream. Next it passes by Aquila and its three notable stars—a bright one between two fainter—and then breaks into alternate deeps and shallows of starry radiance, as it pours downward through Sagittarius and the eastern part of Scorpio to the horizon.

In the constellations named above the owner of a telescope may feast his eyes on innumerable celestial beauties. Take for instance the celebrated Star Cluster in Hercules. The naked eye does not show it, but it can easily be found between the two stars in the quadrilateral before mentioned which lie nearest to the Northern Crown—look about one-third of the way from the northern toward the southern star. A 3-inch telescope will show it; a 5 or 6-inch will reveal it as a wonder.

The northernmost of the two little stars near Vega, called Epsilon Lyræ, is a famous "double-double." An opera glass separates it into two stars; a telescope of 3 inches aperture, or more, divides each of the two again.

A little north of an imaginary line from Arcturus to the brightest star in the Northern Crown is Epsilon Boötis, a beautiful double with contrasted colors. It is a good object for a 3-inch telescope.

The bottom star in the long beam of the Northern Cross, known as Beta Cygni, is a most charming double, the smaller star being bright blue in color. A very small telescope suffices to show it.

Southwest of the last star in the handle of the Great Dipper a lone twinkler of between the second and third magnitudes, Cor Caroli, will be seen. The telescope shows it to be a remarkably fine double, the smaller star having a lilac hue.

Antares is an exceedingly interesting double and can be seen better than last month. A 4-inch telescope will show the little bright green companion of the great red star.

With a low magnifying power sweep the telescope all along the Milky Way from the Northern Cross to the southern horizon; the galactic riches are a perpetual source of astonishment and delight.

THE PLANETS.

Mercury, as an evening star, moves eastward from the sun until July 22, about which time it should be easily seen after sunset. It passes from the constellation Cancer into Leo.

Venus, moving rapidly from Taurus into Gemini and across the latter constellation eastward, is a morning star, fast diminishing in brilliance.

Mars, which passes during the month from Leo into Virgo, is an evening star setting before midnight.

Jupiter, in Virgo, is still conspicuous, although not so favorably placed for observation as in June. On July 2 the shadow of Satellite III. will be on the planet from 9:14 until 10:58 P. M. On July 6 the shadow of Satellite I. will be in transit between 8:42 and 10:54 P. M. On July 7 at 10 h. 1 m. 41 s. P. M. Satellite II. will disappear in eclipse.

Saturn, in Ophiuchus, between Scorpio and Sagittarius, rises before sunset and crosses the meridian, in the middle of the month, about 9 P. M. Accordingly it is well placed for observation. The rings are now opened to about their widest extent, so that the south pole of the planet is hidden behind them while the north pole appears projected against the rings as a background. Titan, the largest satellite, will be west of the planet on July 4; north on July 8; east on July 12; and south on July 16. These dates represent the greatest elongations in each direction.

Uranus remains in Scorpio, and Neptune in Taurus.

THE MOON.

New moon occurs on the afternoon of the 7th; first quarter on the evening of the 15th; full moon on the afternoon of the 22d; and last quarter on the morning of the 29th. The moon is nearest on the 23d, and farthest on the 10th. The lunar conjunctions with the planets occur as follows: Venus July 5, Neptune July 5, Mercury July 9, Mars July 12, Jupiter July 16, Uranus July 18, Saturn July 19. On July 6 about 5 P. M., Venus and Neptune will be in conjunction, less than a degree apart.

AN ANTISEPTIC BROOM FOR HOUSEHOLD USE.

A broom which will contain in itself the means for destroying moths and disease germs is evidently an article which will be of no little value in the household. Such a broom has been invented by Mr. Oscar S. Kulman, of Savannah, Ga.

Referring to our illustration, it will be observed that the antiseptic substances are contained within the broom-straws in a bag held in place by the initial wrap of steel wire and transverse rows of stitching. The penetration of the bag by these rows of stitching opens up numerous outlets for the antiseptic material, in addition to the meshes of the cloth. The action of sweeping causes the antiseptic material to be distributed in limited but sufficient quantities for the thorough deodorizing and disinfecting of the carpet and of the room. The broom itself, ordinarily a fertile breeding-place for bacteria, is constantly kept in a sterilized condition by reason of its antiseptic properties.

A DISINFECTING BROOM.

The bag is so perfectly inclosed and covered by the outside wrapping of straws that the broom presents the appearance of an ordinary broom without any hard external projections to scratch and mar the furniture of an apartment.

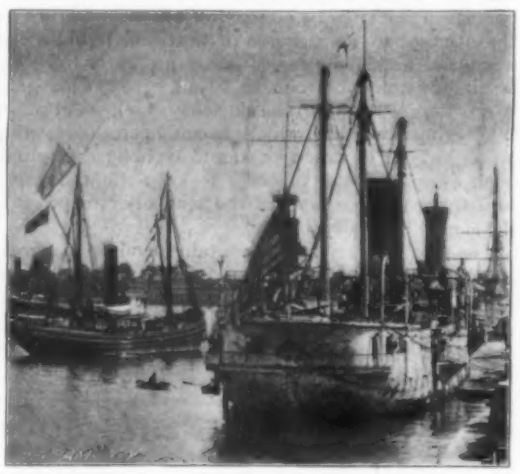
THE "REINA MERCEDES."

In all the literature of the Spanish war there is nothing of greater interest and value than the work entitled "Battles and Capitulation of Santiago de Cuba," by Lieut. José Müller y Tejeiro, second in command of naval forces of the province of Santiago de Cuba, a translation of which was published some time ago by the Office of Naval Intelligence of the United States Navy. To this work we are indebted for particulars of the very important part played by the "Reina Mercedes" in the defense of Santiago.

The "Reina Mercedes" is a protected cruiser of 3,090 tons displacement, and a speed of 17½ knots an hour. She was built at Carthagena in 1887, at a time when the Spanish navy was being reconstructed, largely under the direction and with the professional assistance of Great Britain. Her armament during the operations of the late war consisted of six 6·2-inch Hontoria guns; two 2·7 inch, three 2·2-inch, two 1·5-inch, and six 1·4-inch rapid-fire guns, with two machine guns. She carried the large number of five torpedo tubes, all located above the water line. Her coal supply is 600 tons. At the time of her construction she was comparable in speed and powers of offense and defense with the average cruiser of similar displacement of other navies.

Lieut. Tejeiro tells us that on account of the very bad condition of her boilers at the outbreak of the war, it was impossible for the "Reina Mercedes" to proceed to Havana, as most of the Spanish vessels cruising in that neighborhood did, and it was determined to make what use of her was possible in the defense of Santiago Harbor. She was anchored near the Socapa battery, which is located on the hills west of the entrance to Santiago Harbor. Her yards and top masts were sent down and her starboard side (the one she presented to the mouth of the harbor) was protected by covering it with light cables, with the object of keeping the enemy's shells from entering the torpedo magazine. Her boats assisted in laying the lines of torpedoes which guarded the entrance channel. Four of her 6·2-inch Hontoria guns were dismounted, leaving the two forward guns, which are carried on the main deck in sponsons (one of which is visible in the accompanying illustration), to protect the mine fields. Two of the dismounted guns were dragged up the hill to the Socapa battery and mounted there, and two others were taken across the channel and mounted in the battery at Punta Gorda further up the entrance. "These four guns," says the Lieutenant, "were mounted for the purpose of directly attacking the hostile fleet," and it was a shell from one of the Socapa guns that entered the forward rapid-fire battery of the "Texas," putting it temporarily out of action. Our readers who will care to see what damage such a shell can effect will find the subject illustrated in the SCIENTIFIC AMERICAN of August 20, 1898.

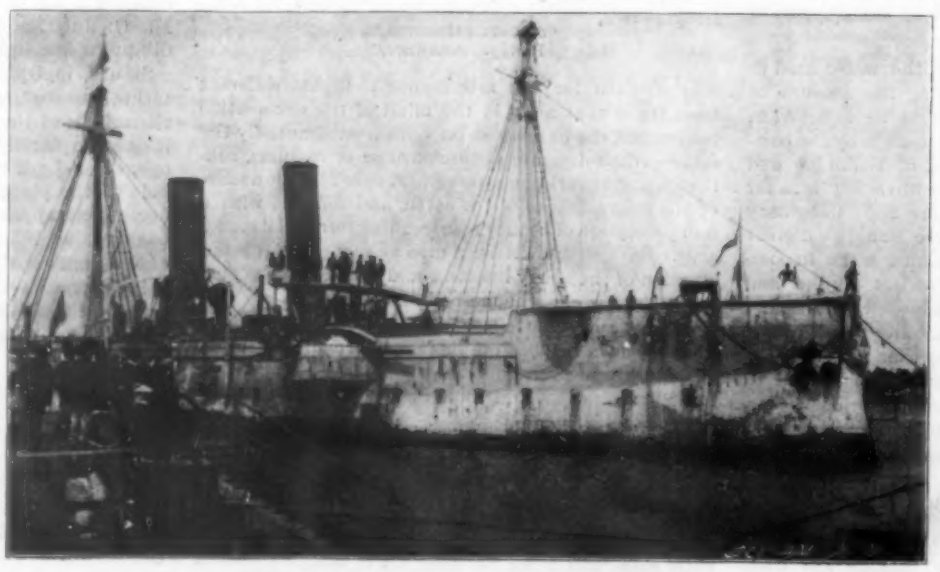
The crew of the "Reina Mercedes," in addition to defending the torpedo lines from the attack of small craft that might attempt to countermine them, mounted at the lower battery of Socapa one 57 millimeter Nordenfeldt gun and four 37 millimeter Hotchkiss revolving guns, all of which were taken from the "Mercedes." All of the artillery that had been removed from this ship was served by the "Mercedes'" men. During the long series of engagements between our ships and the battery the "Mercedes" was frequently struck, and several fatalities occurred among her men. After the final sortie of Admiral Cervera's fleet, it was decided to sink the vessel in the harbor channel in the endeavor to prevent our fleet from coming in, as Hobson had attempted with the "Merrimac" to prevent the Spanish fleet from coming out. In the words of Lieut. Tejeiro, "As the interior of the harbor did no longer have the safeguard of the fleet, as the Bustamente torpedoes had been taken up so that the fleet could go out, and had not yet been replaced, and as, finally, the first line of mines no longer existed, the commander of marine decided (General Toral being also of his opinion) to sink the 'Mercedes' in the narrow part of the channel. Hurriedly, for time was pressing, the wounded and sick from the lost fleet were transferred to the steamer 'Mejico,' which had been converted into a hospital and had hoisted the flag of the Red Cross. Important papers had been saved, memoranda, portable arms, etc., were taken off the 'Mercedes,' and at 8 o'clock P. M., with her commander, Ensign Nardiz, a few engineers and the necessary sailors and pilots, she started toward the entrance with her bow



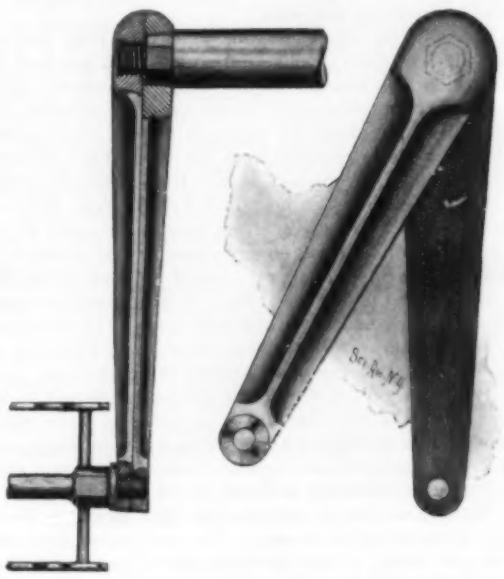
STERN VIEW OF THE "REINA MERCEDES."

anchor and stern spring on the cable ready. At 11:30 o'clock the enemy opened a continuous fire on the ship. She was sunk at the intended place, but unfortunately she did not come to lie across the channel, because it seems a projectile cut the spring from the cable." During their work with the batteries on shore and while serving upon the ship herself, the personnel suffered the following casualties: The commander, Emilio Acosta, and five others were killed, eleven others of the crew were seriously wounded and sixteen were wounded more slightly.

Although the Spaniards looked upon the "Mercedes" as beyond salvage, she was subsequently raised and will now undergo reconstruction at the Norfolk navy yard. She will be reboilered, and thoroughly overhauled, besides receiving a new battery of six 6-inch long caliber rapid-fire guns, firing smokeless powder, and a new battery of smaller rapid-fire guns of standard pattern. In size and armament, speed and coal capacity, she will be practically a sister ship to the six new protected cruisers which were authorized by the last Congress. She will, therefore, prove a timely and serviceable addition to our fleet as well as a notable trophy of the Spanish-American war.



OUR MOST NOTABLE TROPHY OF THE SPANISH WAR.
"Reina Mercedes" at the Norfolk Navy Yard.



A NEW TWO-PART BICYCLE-CRANK.

A NEW TWO-PART BICYCLE-CRANK.

A simple bicycle-crank has recently been patented which may be secured to the crank-shaft without the aid of nuts, the attachment being so effected that a smooth outer surface for the crank is provided, at its connection with the shaft.

One of the accompanying illustrations is a view of a shaft, crank, and pedal, embodying the improvements; and the other is a side elevation of the members of the crank separated at their lower ends.

The crank-shaft at each end is formed with a hexagonal surface and with a reduced, threaded extremity. The crank is made in two parts, the inner surfaces of which are flat and fit closely together. The inner part of the crank, at its upper end, has a hexagonal opening arranged to fit snugly upon the hexagonal surface of the crank-shaft; and the outer part of the crank has a threaded recess arranged to screw upon the reduced threaded extremity of the shaft, and to conceal the end of the shaft. At their lower ends the crank-parts have threaded openings, which, when in alinement, receive the threaded inner end of the pedal spindle.

It is evident that a crank thus constructed dispenses with the use of nuts, and offers no projections liable to become entangled with the rider's dress.

The patents on this crank are controlled by Messrs. Peerstone and Knudston, Room 500, Fisher building, Chicago, Ill.

Waterproof Paper

Is produced by Paul Dresen according to a French patent in the following manner: Mix 28 parts of ordinary olive oil, 28 parts of rapeseed oil, and 28 parts of linseed oil, and add to the mixture a solution of 8 parts of wax in 8 parts of oil of turpentine. This mixture is applied on the paper on one side or both sides by hand or in machine. The paper thus prepared is said to remain waterproof longer than the waterproof paper now in the market.—Dampf.

Kindling Composition.

The Süddeutsche Apotheke Zeitung gives the following formula: Melt 300 parts of resin or colophony and 15 parts of raw paraffine with 15 parts of a fat oil, and add to the molten mass cork-flower, 100 parts; and sawdust, 75 parts. After the cooling press the substance into briquette-shaped pieces or narrow strips.

STEAM MOTOR CARS FOR BRANCH LINES.

In our issue of November 27, 1897, we gave an illustrated description of a steam motor car built by the Schenectady Works for the New England Road. We now present illustrations of a similar type of car constructed by the Baldwin Locomotive Works for the Cincinnati, Hamilton and Dayton Railroad.

The body of the car is divided into three compartments. Entrance is had from a platform at the rear end into a passenger compartment in which are twelve seats with seating accommodation for twenty-eight persons. A toilet and lavatory is provided at one end of the compartment. A door leads from this compartment into the baggage room. The latter is six feet in length and is provided with the usual sliding doors on each side. From the baggage room a side door opens into the engine room.

By reference to our description of the Schenectady car, it will be seen that the boiler was carried directly upon the truck, the floor of the car resting upon a ring of rollers laid around the base of the boiler. In the Baldwin car the boiler is carried upon the floor of the car, and the steam connections to the cylinders are made by means of flexible metallic joints. The boiler is of the vertical tubular type, the fire passing through the tubes, and it is provided with a central tubular magazine for feeding the furnace. The grate is circular, the bars inclining from the magazine outward and downward. The coal is shaken down by a lever actuating a rod which passes up through the center of the grate into the coal, where it terminates in a ball. A dozen water tubes project down into the firebox at the juncture of the magazine with the bottom tube-plate and form a kind of circular cage to guide the coal as it descends from the magazine and spread it out evenly over the grate. These tubes are two inches in diameter, and circulation is secured by dropping a thin tube of iron from the top end of each tube. The flow of the water is upward on the outside of the circulating tubes and downward on the inside.

With a view to getting rid of the steam when the car is running through the streets, a condenser has been placed on the roof of the car. It is built up of 360 thin brass tubes of 1⅛ inches diameter, connected with cast iron headers of such a pattern that the exhaust passes through the entire length of tubing and so far condensed that no exhaust can be either seen or heard.

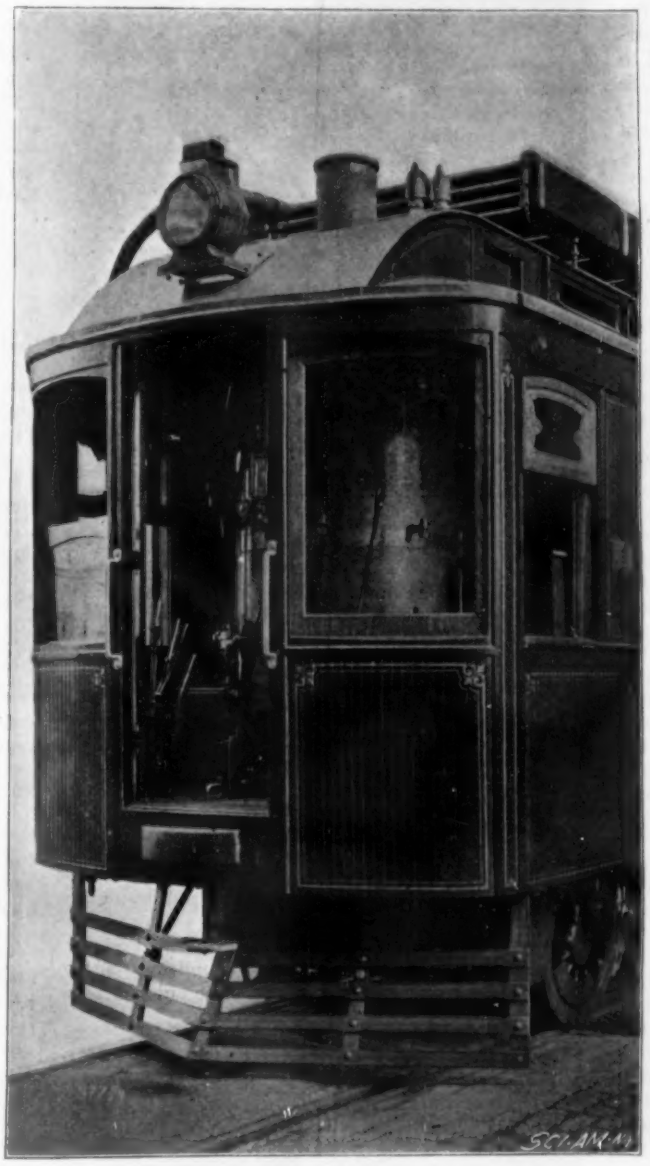
Two tanks, with a combined capacity of 300 gallons, are carried beneath the car between the trucks. One of these supplies the feed water, while the other receives the water of condensation from the roof condenser. The tanks are connected, and both are thus available to supply the feed.

The engine is of the well-known Vauclain compound type, with four cylinders; the high pressure cylinders being 5½ inches diameter, the low pressure of 9 inches diameter, the common stroke being 12 inches. The drivers are 30 inches in diameter. The driving mechanism is carried on frames which form part of the forward truck. The rear truck simply acts as a carrier for the rear end of the car. The car itself is 32 feet 9 inches in length over all; the total wheel base is 16 feet 8 inches, and the driving wheel base is 5 feet. The boiler pressure is 150 pounds to the square inch.

In the preliminary trials of the car it was run for 38 miles without any attention to the fire, the coal magazine feeding the furnace with great regularity. Seventeen miles out of the 38 were run at a speed of 42½ miles per hour.

It should be mentioned that in order to avoid transmitting the vibrations of the engine to the car a novel system of suspension has been adopted for the forward end of a similar car built for the Detroit and Lima Northern Railroad. Four heavy lugs are attached to the sides of the boiler, and through these pass four suspension rods which serve to carry the weight of the car at this end. The load is transmitted through long coiled springs which rest in spherical seats.

This form of motor car has been introduced by the railroads to work in competition with the electric trolley roads which are making such serious inroads upon the suburban railroad traffic. They are used on branch lines and sections of the road where the train service is infrequent or light, and where it is uneconomical to run a single passenger coach with a locomotive of the standard type.



THE CAB OF MOTOR CAR.

STEAM MOTOR CAR FOR SUBURBAN SERVICE.

Fermentation Without Yeast.

Last year a large international congress of chemists was held in the beautiful university of the city of Vienna. The congress was opened with a classic discourse by the famous savant Buchner. Prof. Buchner showed by experiments in the aula of the university his latest important discovery in the field of the physiology of fermentation. According to the same, the yeast plants, as living organisms, do not, as was presumed heretofore, directly mediate the decomposition of sugar and formation of the alcoholic beverages, but it is chemical substances that produce the yeast-cell and cause fermentation. These simple organic bodies can be obtained in the shape of a dry powder by pressing out the yeast-cells, filtering and evaporating. The properties of the new ferment are purely chemical. Among other characteristics, the newly discovered substance endures continued heating without losing its fermentative power. Considering these interesting facts, new and important possibilities are opened up to the fermentation industry. Since chemistry is continually becoming more perfect and productive in the field of synthesis, it is to be expected with certainty that in future this isolated chemical ferment will also be produced artificially, and that with the knowledge of this body further discoveries of similar as yet unknown substances will follow.

Moreover, experiments which have been conducted with other micro-organisms, in addition to those of Buchner, justify the presumption that the specific activity of the pathogenous bacteria in the diseased organism is a chemical process. Bacteria multiply very rapidly, if conditions essential to life are favorable, the most heterogeneous substances bringing about decomposition in the organs of the body, somewhat similar to the processes of decomposition in fermentation.

The bacillus of diphtheria, for instance, is known to produce a specific poison, which enters the circulatory system of man from the place of infection and causes a fatal sickening of the whole body.

With other germs, such as those of cholera, the products of change of matter forming in the digestive tract by the activity of the cholera vibriones constitute the starting point of a different but likewise typical disease.

In the same manner in which Behring, Kitasato, and others have prepared anti-toxines against these toxines of the inciters of infection, and have produced serum preparations by means of animal vaccination, it will be the mission of chemistry to isolate these assimilation products of micro-organisms, which bring about the decay of complicated organic structures, and to produce them synthetically in chemical laboratories.

On the other hand, science will discover a process which will solve the problem of producing suitable antidotes for all malignant infections, while the harmless artificial assimilation products of micro-organisms may be employed for perfecting various products of trade and industry.—Technische Berichte.

Holmes' Comet.

A telegram has been received at the Harvard College Observatory from Prof. J. E. Keeler, of Lick Observatory, stating that the comet Holmes was observed by Perrine on June 10. The comet was originally discovered by Holmes in London, November 6, 1892, and has a period of about seven years. By January 12, 1893, it had become very faint, but on January 16 it was found to have undergone a remarkable change, an outburst of light having occurred. It resembled a bright planetary nebula of about the seventh magnitude, the nucleus being at first hazy, but afterward becoming sharper and about as bright as a star of the eighth magnitude.

EXTENSIVE deposits of bauxite have been discovered in New South Wales. As this is one of the best raw materials for the manufacture of aluminum, the deposits will probably be of value.

THE SNAKE DANCE OF THE MOKIS.—I.

BY GEORGE WHARTON JAMES.*

In five of the seven villages of the Hopi—improperly termed the Moki—there occurs, every other year, the most wonderful religious ceremony known. It is conducted with decorum, dignity, and reverence, and yet, to many white onlookers, it seems wild, thrilling, chaotic, and disorderly. Having witnessed the ceremony eight times, and four times having been admitted to the secret kivas, or underground sacred chambers of the two fraternities who conduct the dance, I feel at liberty to speak of its religious character, the dignity with which it is performed, and to suggest the only point of view from which the visitor may obtain the right understanding of its mysteries.

The province of Tusayan is situated in northern Arizona, about one hundred miles due north of the town of Winslow, on the line of the Santa Fe Railway. This province was first exploited by Ensign Tobar, of Coronado's force, after the "Seven Cities of Cibola" had been discovered at what we now know as Zuni. This was 350 years ago. There have been changes in the valleys and their locations in that time, but the number of the cities is still seven, and the general characteristics but slightly altered. The seven villages are located on three mesas, or tongues of land, which are thrust out from the main plateau into a sandy plain, through which, in the rainy season, a stream meanders to lose itself in the sand. The easternmost of these three mesas is generally known as the "first mesa," on account of its nearness to Keam's Canyon, which for many years was practically the only known gateway into the Hopi region. On this first or east mesa are the three towns of Tenea, Sichomavi, and Walpi, the latter being the best known town of the province, the one most visited by the whites, and, consequently, the one that seems to be the most civilized. It is the only village on this mesa where the snake dance occurs. On the middle mesa, about nine miles to the west, are three more villages. This mesa is not a level, rocky plateau, as are the eastern and western mesas. It is divided into two parts, in the western portion of which is the town of Shimopavi, and from which a deep sandy ravine must be crossed ere the eastern portion is reached, on two distinct terraces of which are Mashonguavi and Shipauluvi. On the western or third mesa is the largest of all the Hopi villages, Oraibi, and all these four villages of the two westernmost mesas have their own celebration of the snake dance every other year.

This dance alternates in each village with the Lelentu, or flute ceremony, so that, if the visitor goes on successive years to the same village, he will see one year the snake dance and on the following year the Lelentu. But if he alternates his visits to the different villages he may see the snake dance every year, and, as the ceremonies are not all held simultaneously, he may witness the open air portion of the ceremony, which is the snake dance proper, three times on the even years and twice on the odd years. For instance, this year, 1899, it will occur at Walpi and Mashonguavi; next year, at Oraibi, Shipauluvi, and Shimopavi.

The Hopi are keen observers of all celestial and terrestrial phenomena, and, as soon as the month of August draws near, the snake and antelope fraternities meet in joint session to determine, by the meteorological signs with which they are familiar, the date upon which the ceremonies shall begin.

This decided, the public crier is called upon to make the announcement to the whole people. Standing on the housetop, in a peculiarly monotonous and yet jerky shout he announces the time when the elders have decided the rites shall commence. Sometimes, as at Walpi, this announcement is made sixteen days before the active ceremonies begin, the latter, in all the villages, lasting nine days and terminating in the popularly known open air dance, after which four days of feasting and frolic are indulged in, thus making, in all, twenty days devoted to the observance.

But for all practical purposes nine days covers all the ceremonies connected with it.

At Walpi, on the first of the nine days, the first ceremony consists of the "setting up" of the antelope altar. This is an interesting spectacle to witness, as at Walpi the altar is more elaborate and complex than in any other village. It consists, for the greater part, of a mosaic made of different colored sands, in the use of which some of the Hopi are very dexterous. These sands are sprinkled on the floor. First a border is made of several parallel rows or lines of different colors. Within this border, clouds are represented, below which four zigzag lines are made. These lines figure the lightning, which is the symbol of the antelope fraternity. Two of these zigzags are male, and two female, for all things, even inanimate, have sex among this strange people. In the place of honor, on the edge of the altar, is placed the "tipoui," or palladium of the fraternity. This consists of a bunch of feathers, fastened at the bottom with cotton strings to a round piece of cottonwood. Corn stalks, placed in earthenware jars, are also to be seen, and then the whole of the remaining three sides of the altar are surrounded by crooks, to which feathers are attached, and bahos, or prayer sticks. It was with great trepidation I dared to take my camera into the mystic depths of the antelope kiva. I had guessed at focus for the altar, and

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Snake Altar God.

when I placed the camera against the wall, pointed toward the sacred place, the antelope priests bid me remove it immediately. I begged to have it remain so long as I stayed, but was compelled to promise I would not place my head under the black cloth and look at the altar. This I readily promised, but, at the first opportunity, when no one was between the lens and the altar, I quietly removed the cap from the lens, marched away, and sat down with one of the priests while the dim light performed its wonderful work on the sensitive plate. The photograph here reproduced is the result.

The other ceremonies of general interest which occur during the underground secret rites are the singing of the sixteen dramatic songs, and the washing of the snakes. The sixteen songs are a kind of Moki Edda or Book of Hopi Genesis. Snake and antelope priests meet solemnly in the kiva of the latter. The chief priests

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Old Woman at Walpi.

THE SNAKE DANCE OF THE MOKIS.—I.

take their places at the head of the altar, and the others line up on either side, the snake priests to the left, the antelope to the right. Kneeling on one knee, the two rows of men, with naked bodies, solemn faces, bowed heads, no voice speaking above a whisper, demand respect for their earnestness and evident sincerity. To one unacquainted with their language and the meaning of the songs, the weird spectacle of all these nude priests, kneeling and solemnly chanting in a sonorous humming manner, their voices occasionally rising to a grand crescendo, speedily to diminish to a thrilling pianissimo, produces a seriousness wonderfully akin to the spirit of worship.

The meaning of the songs, when their burden is studied, is that they give the legendary lore of the snake and antelope fraternities as to the origin of their ancestry and the methods the gods instructed them to follow in order that they might be blessed with rain and fertilization of their crops and productiveness among their herds. Listen to a brief summary of these interesting songs.

The Zunis, Mokis, Piutes, Coconinos and white men all made their ascent from the lower world to the earth's surface through a portion of Pisis-bai-ya (the Grand Canyon of the Colorado River), near where the Little Colorado empties into the main river. As the various families emerged, some went north and some south. Those that went north were driven back by fierce cold which they encountered, and built houses for themselves at a place called To-ko-ná-bi. But, unfortunately, this was a desert place where but little rain fell, and their corn could not grow. In their pathetic language the Hopi say "The clouds were small and the corn weak." The chief of the village had two sons and two daughters. The oldest of these sons, Tiyo, resolved to commit himself to the waters of the Colorado River, for they, he was convinced, would convey him to the underworld, where he could learn from the gods how always to be assured of their favor.

(This idea of the Colorado River flowing to the underworld is interesting as illustrative of Hopi reasoning. They said, and still say, this water flows from the upperworld in the far-away mountains, it flows on and on, and never returns, therefore it must go to the inner recesses of the underworld.)

Tiyo made for himself a kind of coffin boat from the hewed-out trunk of a cottonwood tree. Into this he sealed himself and was committed to the care of the raging river. His rude boat dashed down the rapids, over the falls, into the secret bowels of the earth (for the Indians still believe the river disappears under the mountainous rocks) and finally came to a stop. Tiyo looked out of his peepholes and saw the spider woman, who invited him to leave his boat and enter her house. The spider woman is a personage of great power in Hopi mythology. She it is who weaves the clouds in the heavens, and makes the rain possible. Tiyo accepted her invitation, entered her house, and received from her a powder which gave him the power to become invisible at will. Following the instructions of the spider woman, he descended the hatch-like entrance to Shi-pá-pu, and soon came to the chamber of the snake-antelope people. Here the chief received him with great cordiality, and said:

"I cause the rain clouds to come and go,
And I make the ripening winds to blow;
I direct the going and coming of all the mountain animals.
Before you return to the earth you will desire of me many things,
Freely ask of me and you shall abundantly receive."

For a while he wandered about in the underworld, learning this and that, here and yonder, and at last returned to the snake-antelope and snake kivas. Here he learned all the necessary ceremonies for making the rain clouds come and go, the ripening winds to blow, and to order the coming and going of the animals. With words of affection the chief bestowed upon him various things from both the kivas, such as material of which the snake kilt was to be made, with instructions as to its weaving and decoration, sands to make the altars, etc. Then he brought to Tiyo two maidens, both of whom knew the snake-bite charm-liquid, and instructed him that one was to be his wife and the other the wife of his brother, to whom he must convey her in safety. Then, finally, he gave to him the "tipoui," the sacred standard, and told him, "This is your mother. She must ever be protected and revered. In all your prayers and worship let her be at the head of your altar or your words will not reach those above."

Tiyo now started on his return journey. When he reached the home of the spider woman, she bade him and the maidens rest while she wove a pannier-like basket, deep and narrow, with room to hold all three of them. When the basket was finished she saw them comfortably seated, told them not to leave the basket, and immediately disappeared through the hatch into the lower world. Tiyo and the maidens waited, until slowly a filament gently descended from the clouds, attached itself to the basket, and then carefully and safely drew Tiyo and the maidens to the upperworld. Tiyo gave the younger maiden to his brother, and then announced that in sixteen days he would celebrate the marriage feast. Then he and his betrothed retired to the snake-antelope kiva, while his brother and the other maiden retired to the snake kiva. On the fifth day after the announcement the snake people from

* The photographs are by Mr. James. It is not possible to print all of the engravings in the present issue; the reader is referred to the second article.

the underworld came to the upperworld, went to the kivas, and ate corn pollen for food. Then they left the kivas and disappeared. But Tiyo and the maidens knew that they had only changed their appearance, for they were in the valley in the form of snakes and other reptiles. So he commanded his people to go into the valleys and capture them, bring them to the kivas and wash them and then dance with them. Four days were spent in catching them from the four world quarters; then, with solemn ceremony, they were washed, and, while the prayers were offered, the snakes listened to them, so that when, at the close of the dance, where they danced with their human brothers, they were taken back to the valley and released, they were able to return to the underworld and carry to the gods there the petitions that their human brothers had uttered upon the earth.

This, in the main, is the snake legend comprised in the sixteen songs which are sung with many interesting and dramatic episodes. The youth and the maidens are represented, the snake-antelope priest of the lower world giving the instructions to Tiyo which were forever after to be the salvation of his people's land from drought and famine. Hence the keen interest and sacred energy displayed by all the priests as they sing, and sing again, and yet again, the songs of their forefathers.

The catching of the snakes foreshadowed in the snake legend is faithfully carried out each year by the snake men. After earnest prayer, each man is provided with a hoe, a snake whip, consisting of feathers tied to two sticks, a sack of sacred meal (corn meal especially prayed and smoked over by the chief priest), and a small buckskin bag, and on the fourth day after the setting up of the antelope altar they go out to the north for the purpose of catching the snakes. Familiarity from childhood with the haunts of the snakes, which are never molested, enables them to go almost directly to places where they may be found. As soon as a reptile is seen, prayers are offered, sacred meal sprinkled upon him, the snake whip gently stroked upon him, and then he is seized and placed in the bag. In the evening the priests return and deposit their snakes in a large earthenware olla provided for the occasion. I should have noted that before they go out their altar is erected. This varies in the different villages, the most complete and perfect altar being at Walpi. At Oraibi the altar consists of the two wooden images—the little war gods—named Pū-ū-kon-hoy-a and Pal-un-hoy-a; and in 1898 I succeeded, with considerable difficulty, in getting into the snake kiva and making the accompanying photograph of these gods. The small figures on each side of them are hunting fetiches made of stone, and the snake bags may also be seen.

This catching of the snakes occupies four days, one day for each of the four world quarters.

Then on the noon of the ninth day the ceremony of washing the snakes takes place in the snake kiva. This is such an exciting and thrilling ceremony that I will leave its description for the next article, in which also the public snake dance will also be described and pictured.

The Fossil Deposits of Wyoming.

BY L. P. GRATACAP.

The recent announcement in the public prints of the discovery of a gigantic extinct animal in Wyoming, whose proportions are sufficiently astounding to meet the sensational requirements of the most advanced journalism, has excited popular interest in the remarkable desposits of the Mesozoic age in Wyoming and renewed curiosity in the strange animal remains they contain. This colossal beast is described in one paper in the following terms: "It is the complete petrified body of an animal weighing 40,000 pounds. The bone monster is a relic of the Jurassic age, 130 feet long, 35 feet high at the hips, and 25 feet at the shoulders." The further statement is made that the management of the Union Pacific Railroad, in its creditable anxiety to "transport the great fossil to a less obscure place," is willing to place its facilities at the disposal of science. The dimensions here given are certainly staggering and some doubt may be reasonably indulged in as to the absolute accuracy of the relations of length and height, but they clearly reveal the reptilian nature of the creature Prof. Reed has found, and place it among the great dinosaurs, the prevalence of whose remains in the Cretaceous and Jurassic inland seas of Wyoming has been so clearly established. The dinosaurs were land animals or lived amphibiously on land and in fresh water swamps, possibly even along the margins of the salt oceans; their limbs were unadapted for swimming, and curious developments of horns brought their cranial structure into ludicrous resemblance, in some instances, to that of the rhinoceros. They belonged to a rather highly developed class of reptiles, though, as Marsh has shown, their order of intelligence was low.

They flourished from the Triassic to the Cretaceous, and in Wyoming have been exhumed in surprising numbers, and with dimensions that seem incredible, while the Laramie Cretaceous, to which zone this latest newspaper marvel may be referred, has been distinguished for its possession of their skeletons. In the University of Kansas an immense skull of one of these anomalous beasts decorates a shelf in the museum, with horns over three feet in length on the top of the head, while another, a foot long, gives facial prominence to its nose. This skull is seven feet long, five feet wide and five feet high. A thigh bone of one of these pleasing ornaments of a past age measures over six feet in length, and the monster weighed 11,000 pounds. This individual, with its covering of flesh, must have formed a generous burden for the quaking earth it walked over when, in the remote period it now signalizes, it wandered along the margin of an inland sea.

The range in size of the dinosaurs is interesting, the smallest being computed to equal a cat in size, while the largest have in linear extent measured over sixty feet. Prof. Marsh has created three great divisions into which these animals may naturally be grouped, the Theropoda or the carnivorous forms, and the Sauropoda and Predentata, the herbivorous members, the last being again split up into three separate suborders, of which the first (Stegosauria) includes dinosaurs protected by dermal plates, the second (Ceratopsia) those bearing horns, and the third (Ornithopoda) forms that "in shape and structure most nearly resemble birds."

These wonderful creatures seem to have begun their course of development in the early Triassic, to have widened their areas of habitation and their structural variety in the Jurassic, and attained in the Cretaceous an amplitude of specialization prophetic of their decline, for, with the close of this period, they disappear from the surface of the earth. They had a wide range, being found in South America, extensively in North America, and in Europe, Asia, Africa and Australia. Such explorations as are now enlisting scientific attention throughout the world and such especially as are fostered in this country, will more and more reveal the affinities and features of this most strange family, and delight the imagination with closer views of that portentous fauna of the Mesozoic day.

It is so customary to look to the West for the revelations of vertebrate palæontology that few of the public realize that along the shores of Connecticut and in the interior of New Jersey, when the Triassic ocean was forming its deposits over both those States, dinosaurs were moving their unwieldy bodies, leaving the traces of their presence in the so-called "bird tracks," those tri-dentate impressions in sandstone which are so commonly seen in our museums. Indeed, in the Triassic sandstone of Connecticut, in 1818, one of the first discoveries of the skeleton of a true dinosaur was made, remains in part now preserved in the museum of Yale University. Again, bones of a dinosaur were found in Lehigh County, Pa., in 1847, and later in Prince Edward Island, Canada.

But the paradise of the collector has been in the West, in the Rocky Mountain region, where the remains are abundant and wonderfully preserved, and where the classification of the family has been made possible by the number of forms discovered.

Here at Lake Como, Wyoming, the celebrated Atlantosaurus beds are found, yielding hundreds of individuals, and one species (Atlantosaurus immanis, Marsh) which possibly attained the length of 80 feet. In Colorado, in South Dakota, in Kansas, the Jura-Triassic and Cretaceous areas also yield up to the zeal and patience of science their marvelous contents of fossil bones, entire skeletons, and huge or grotesque skulls.

But while from their more complete exposition the dinosaurs of these Mesozoic beds in the West rivet the attention of the student accompanying them were numerous representatives of allied groups of animal life, and the picture of exuberant fertility in faunal variety would be very incomplete without allusion to these associated forms. Birds of the Hesperornis type, wingless, measuring six feet from point of bill to the tip of the feet, with small conical teeth set firmly in the jaw, and aquatic in habit, were then moving in the shallow bays or estuaries, while through the air birds of the Ichthyornis type were swiftly passing, their habits of life in preying upon fish bringing them in numbers to the shore line of the continent. The huge Masasaurs, marine lizards, attaining a length of forty feet, then dashed through the waters, chasing fish, or engaged in savage duels, the traces of whose ferocity can yet be distinguished, according to Prof. Williston, in the exostosial growth in their skeletons. Turtles moved sluggishly along the shores of the Cretaceous continent or basked motionless upon the surface of the sun-heated bays. The picture which science in its retrospective glance can thus summon to our eyes surpasses the most weird dreams of fancy, and impresses the mind more and more profoundly with the mystery of that progression of life which now, in this modern day, seems to have reached the limit of its possible evolution.

CEMENT for tin is produced by dissolving equal parts of shellac and colophony in 6 parts of strong spirits of wine.—Neueste Erfindungen und Erfahrungen.

Alcohol in the Human System.

Prof. W. O. Atwater, of Wesleyan University, at the meeting of the Middletown Scientific Association on June 12, gave the results of experiments which he had recently carried out upon the effects of alcohol on the human system. These experiments were conducted with the aid of his respiration calorimeter, which we intend to illustrate in an early issue. Sensational accounts of the experiments have appeared in newspapers from time to time, but Prof. Atwater in his paper gave, for the first time, an authentic account of certain of his experiments which were conducted under the auspices of a committee of fifty for the investigation of the drink problem. The special object of the experiments was to determine the nutritive value of alcohol. Pure alcohol was administered with water or coffee. Sometimes it was also given in the form of brandy or whisky, wine or beer. The alcohol was taken with the ordinary diet. The amount consumed was equivalent to 2¼ ounces of absolute alcohol or 5 or 6 ounces of average commercial liquor. It was found that the alcohol was oxidized as completely as bread, meat, or other form of food. In the oxidation all of the potential energy of alcohol was transformed into heat and muscular work, that is to say, the same use was made of alcohol as that of ordinary food materials. The alcohol protected the material of the body from undue consumption as effectively as the corresponding amount of sugar, and starch. Alcohol, like the fats, starch, and sugar, does not form tissue, but it yields energy. To express it popularly, it serves as fuel for the system. Prof. Atwater was careful to explain that his experiments were simply to get at the real facts in the case. Of course the conclusions which he deduces are not to be considered as advocating the use of alcohol. At the same time, it is no more than fair to state that the results of scientific experiments and the latest researches tend to show that alcohol is not a poison, but is a food.

The National Export Exposition at Philadelphia.

The National Export Exposition to be held in Philadelphia from September 14 to November 30, 1899, will occupy over sixty acres of ground. The site is admirably adapted for exposition purposes, being within a short ride of the City Hall. The main building is 1,000 feet long and 400 feet wide. It includes three pavilions two stories in height and a spacious auditorium with a seating capacity of 5,000. In this auditorium the sessions of the International Commercial Congress will be held and concerts will be given. The pavilions are constructed of bricks and structure steel and are each 90 by 380 feet. The walls of the main building are covered with "staff," and the cornices are made of the same material. A broad driveway will skirt the main building. A spacious promenade dotted with Japanese pagodas containing rustic benches will encircle the main building. Wide walks will be laid to the detached structures containing special exhibits. A special track will be provided for automobiles. The grounds will be neatly laid out, and the space has been so utilized that large crowds can be handled with safety and convenience. The power house measures 58 by 190 feet and is situated on the river side of the grounds and has a flat roof which will be utilized as a roof garden.

American Pipe in Russia.

The city of Odessa, Russia, is now engaged in increasing its municipal waterworks. The Russian authorities gave the contract for the iron pipe to an American firm. The French Ambassador at St. Petersburg asked to have the contract taken away from the American firm to be given to a French firm on the extraordinary grounds of the close relationship between Russia and France. It is strange to say that the Russian Foreign Office took the matter up, and the Governor of Odessa was ordered to investigate and see what could be done. He was obliged to report that the town refused to change its arrangements, as they were quite satisfied with the American contract. The French Ambassador then asked that the specifications be changed so that the French pipe could be used, but the town again declined to do this on the ground that the best engineers favored the shape called for in the specifications, which was the shape used by the Americans. American pipe is now well known all over the world and our exports of pipe are constantly increasing.

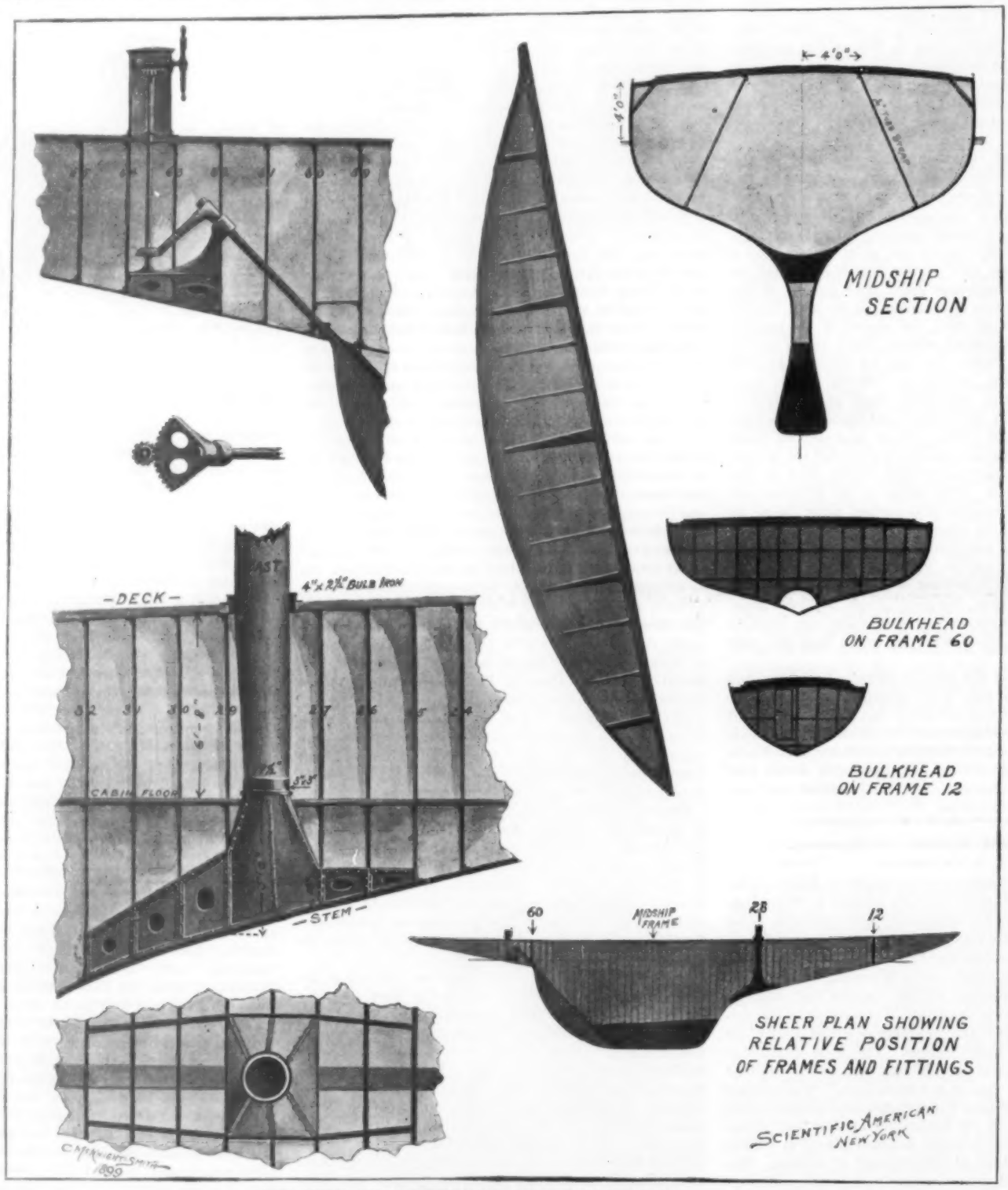
WE have received the Annual Report of the American Museum of Natural History for 1898. The frontispiece shows the building which will be entirely finished in a few months. The entire front is now practically completed and shows one of the most imposing façades possessed by any museum in the world. The report of the President shows that the Society is in a very flourishing state, and that it has accomplished much for American science. A number of well-selected half-tone engravings are inserted, and the report gives a list of members, additions to the library, connections, etc. Work is now proceeding on three distinct sections of the building at the same time.

THE LINES AND CONSTRUCTION OF THE YACHT "COLUMBIA."

Designer Herreshoff has never been known to take a retrograde step. Each yacht that he has turned out in any class has been faster than its predecessors, and we have every confidence, therefore, that "Columbia" will be superior to "Defender." In an article published in the Proceedings of the United States Naval Institute, in 1897, on the subject of the yacht "Defender," Naval Constructor Hobson (now of "Merrimac" fame) says:

"The idea that gives the distinguishing feature to this advanced type is the realization of extreme sail-carrying power from a great metacentric height—initial and under inclination—realized from the disposition of weights. The great metacentric height, and consequent sail-carrying power, is derived more from the element of weight than from the elements of form. The method adopted in realizing the low position of the center of gravity is that of reduction in weight of hull and fittings, and the addition of weight to the keel—the weight being taken from the upper portions and added to the lowest point. The method of realizing a reduction of high weights is the use of light materials and light scantlings, with a light method of construction and fastenings. The reduction of frictional resistance and the liability to deterioration are sought in the use of manganese bronze for water-washed portions."

Comparing "Columbia" with "Defender," the question arises as to where she exhibits a gain in construction and form over the earlier boat. In general, it may be said that, while she derives equal sail-carrying power from the element of weight due to her light construction — in which respect, in spite of the absence of aluminum, she is probably at least equal to the "Defender"—she derives more power from the element of form than did the "Defender." She has a gain in distribution of weight, due to the fact that her lead is carried lower down, that the keel is straight and level on the bottom for its full length, and that the greatest thickness of the lead is within a few inches of its bottom, and not, as in the "Defender," two or three feet from its lowest point. This is evident from a comparison of the midship section of the "Columbia," as given above, with that of the "Defender." From the same section it will be seen that the changes in form in the new boat will give her considerably more stiffness and power. The bilge is considerably harder, that is to say, it rounds with a shorter radius, the floor is flatter, with less dead rise, and the curve where the floor rounds into the keel has a smaller radius than in the "Defender." The effect of these changes is that the center of displacement of the hull proper is raised, while at the same time, as we have just seen, the center of gravity of the lead is lower. These changes, coupled with an increase of over a foot in the beam, will evidently enable the new boat to carry a heavier press of canvas than the "Defender." At the same time, although her beam is greater, the lines of the "Columbia," because of her greater length, are finer than those of the older boat. She is from a foot to a foot and a half longer on the waterline and between 5 and 6 feet longer on deck. Her overhang, both forward and aft, is truly enormous, being about 18 feet forward and 22 feet aft as against 15 feet forward and 17½ feet aft in the "Defender." The lines are carried out in a gradual sweep that will give the boat long and easy sailing lines when she lies down under a press of canvas. The topsides amidship have a slight "tumble home" or inward inclination, but this only extends for a short distance amidship, and, as will be seen from the sections at frames 12 and 60, the sides flare out liberally on the counter and toward the bow.



THE LINES AND CONSTRUCTION OF THE YACHT "COLUMBIA."

Length on water line, 80 feet 6 inches; beam, 24 feet 2 inches; draught, 20 feet.

It will be evident from the drawings and our description that the "Columbia" is more completely of the fin-keel type than was the "Defender." The fin is narrower, the lead lower, and the body of the boat is wider and not so deep.

As regards the constructional details, the drawings which we herewith publish speak for themselves. The deck beams are of bulb angle steel rolled to a special section, above which there is a system of diagonal intersecting steel straps, forming a horizontal trussing to distribute the lateral strains of mast and stays and resist the torsional and racking strains to which the hull is subject when in a seaway or heeling to a strong breeze. Above the horizontal strapping is a two-inch deck of wood. The wood deck does not extend to the outside rail, but finishes on either side at steel deck-stringers, which form, as it were, the chords of the deck trussing. The stringer is 20 inches wide amidships, and tapers to 10 inches at the bow and stern. Along its inner edge is a 1¾×1¾ inch steel angle, and on the outer edge is riveted a steel bulb angle, 1¾×8¼ inches, the bulb flange forming the rail of the boat. About 6 feet below the deck is a very light platform deck forming the cabin floor, and a series of 2-inch tubular steel struts extends diagonally from the deck beams to the side of the vessel just above the platform deck, the struts being fastened at each end to longitudinal bulb angles which extend fore and aft beneath the deck beams and across the frames at the points indicated in the drawings. About the neighborhood of the garboard strakes, where the floor rounds into the keel, the vessel is strengthened by a series of steel plates, as shown, which extend from frame to frame throughout that part of the body of the boat which lies immediately above the lead keel.

Another of our drawings shows the method of stepping the mast, which is placed at frame 28. The mast-ring is a bulb angle steel, 2½ × 4 inches, and measures 26 inches in diameter, the mast being 21¼ inches in diameter at the level of the deck. The mast step, which is 6 feet below the deck, consists of a half-inch steel plate which is slightly dished downward, and carries above it a steel ring forged from a 3 × 3 angle. Below the plate is another ring, 2 × 2 inches, the two rings and the plate being firmly riveted together. The step is carried by a strong box-like structure of steel plating, the bottom of which is riveted to the hull plating and to the frames. The fore and aft strains are distributed over a considerable section of the hull by means of steel keelson plates which extend forward between frames 27 and 25, and aft between frames 29 and 32. All of this work is flanged and carefully riveted and forms an extremely light, strong, and well-designed construction. The distance from the deck to the step plate is 6 feet 4⅛ inches and from the plate to the stem of the vessel about 5 feet. The depth of the "Columbia" at this point is therefore about 11 feet. The deck and hull in the wake of the mast are also stiffened by six 1¼-inch round steel stanchions, three on each side, which extend diagonally from the mast step to the deck stringers which form the scuppers or waterway of the yacht.

Others of our drawings show the construction of the rudder and the novel methods which have been devised for carrying the same, together with the new form of steering gear, which was designed specially

for the "Columbia." The rudder post is about 27 feet in length over all. It enters the hull between frames 59 and 60. Here it is provided with a stuffing-box to prevent the entrance of water. The rudder consists of bronze plates riveted upon a frame, as shown in the enlarged drawing, and it is 4 inches thick at the post and tapers to between 1 and 2 inches in thickness on the outer edge. To the top of the rudder post is attached a steering quadrant, of the form shown in the small drawing of the same. It extends to the rear and downwardly and engages a bevel wheel carried at the bottom of a vertical shaft which rises through the deck, and carries at its upper end another bevel wheel, which is itself in engagement with a bevel wheel on the shaft of the steering wheel. Immediately below the quadrant the rudder-post passes through a heavy casting which is bolted to a plate steel foundation and serves as a top bearing for the post and at the same time carries practically the whole weight of the rudder, which is kept in place by the usual pintles and gudgeons. At frames 20 and 60 are watertight bulkheads of light plating.

Will "Columbia" win? We can only say that she is a logical development and an unquestioned improvement on "Defender," and "Defender" is a few minutes faster than the fastest boat that has ever come for the "America" cup.

SEA LION ROOKERIES OF SOUTHERN CALIFORNIA.

BY C. F. HOLDER.

The fact that the authorities of San Francisco, in answer to an appeal from the fishermen, have begun a warfare against the sea lions of the vicinity, calls attention to the few remaining and very interesting rookeries in Southern California. A half century or so ago sea elephants lived in large herds on Santa Catalina Island, but they were utterly and completely wiped out of existence by the sea elephant hunters, who waged continual war upon them. The same influence has been directed against the sea lion, which is soon destined, if not protected, to disappear from the Pacific coast of North America.

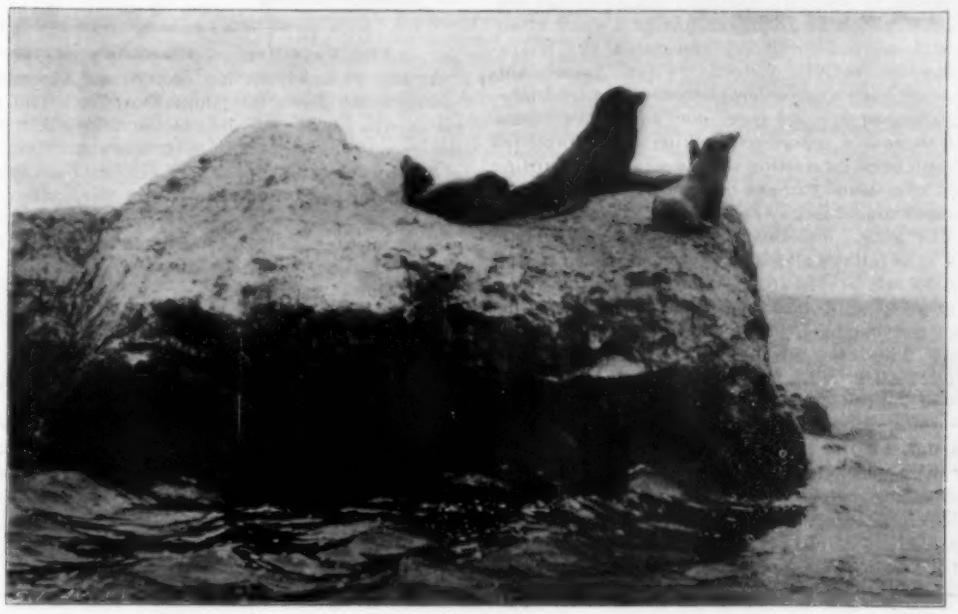
One of the most interesting herds found in Southern California is on Santa Catalina Island. The rookery is on the extreme southeastern end, where a small group of rocks rise above high water and are connected to the mainland at low water. Here the sea lions make their headquarters and live unmolested, being protected by local rules. They number perhaps one hundred, and are controlled or dominated by two or three large bulls. The accompanying graphic photograph shows about one-half the herd on the beach in the month of May, when they leave the rocks and take to the beach near at hand, where the young are born. The herd is shown menacing a boat which is floating off the shore, the photographer being in the near foreground.

Their actions are very interesting, and at this time they make vigorous protests when a fishing boat approaches; yet they are so tame that they allow visitors

HERD OF SEA LIONS ON SANTA CATALINA ISLAND.

to row within fifteen or twenty feet of them and appear to be perfectly indifferent. Santa Catalina is nearly sixty miles around and offers many inducements for seals and sea lions at various points; but for some reason they have selected this spot that is by no means smooth, though it can be called a lee, and is open to the fierce southeast gales of winter; in the summer and most of the year the rookery is protected.

In view of the complaint of the fishermen of San Francisco that the sea lions were devastating their grounds, some inquiries were made at the island mentioned; but while it was acknowledged that the one hundred or more sea lions consumed large quantities of fish, except in certain instances to be referred to, the animals were not considered a nuisance. I believe, however, that the sea lions devour a vast amount of fish and that the fishermen do not appreciate or feel it, as this island is remarkably rich in its supply of fishes. The sea lions bask on the rocks nearly all day,



SEA LIONS BASKING.

and at about four o'clock start out, singly or in groups, on a feeding trip upshore. The young sea lions, the yearlings and two-year-olds go in bands, and often make their trip apparently for pleasure. They enter Avalon Bay like porpoises, swimming at the top of their speed, bounding out of the water in twos and threes and more, making the circuit of the bay in a few moments. After dark, generally from nine to ten or later, the large sea lions enter the bay to feed. They are scavengers in a sense, feeding on any dead fish that may have been washed offshore or thrown away by the fishermen. At this time they make the little rock-bound bay reverberate with their barking. Bringing the fish from the bottom, they rise to the surface and, with violent swings from side to side, endeavor to tear it into pieces, in which they ultimately succeed. The old males are rarely if ever seen feeding in the daytime.

The actions of the large sea lions in feeding here are most interesting, and their speed under water is marvelous. The writer once took as a point of observation a high cliff from which every object on the bottom could be distinctly seen. At one time a single sea lion had surrounded a school of sardines, so terrifying them that they formed a dark ball about six or seven feet around, into which the seal constantly plunged, taking the small fry by the mouthful. The school was so completely terrified that they did not move twenty feet in an hour, remaining in the same general position.

So tame are certain sea lions that they sometimes haunt the wharf at Avalon. Standing upright at the bottom, with their tails resting upon it, they watch every movement of the angler, deftly removing his bait when thrown over. At other times they have been known to follow the boat and drive all the fish away which the fisherman by patient chumming had gathered about him. A Venetian fisherman at this island informed the writer that a sea lion often accompanied him to his gill-nets, and every few moments descended to investigate, and literally took the fish from the nets as fast as they entered, rising to the surface and tossing them into the air in seeming derision and outraging every sense of propriety. Yet these fishermen have never made a formal complaint against the seals and sea lions. The reason is doubtless that the sea lion rookery is an attraction to tourists, and nearly all the fishermen are interested in transporting them to the seal rocks; hence what they may lose by the depredations of the animals they gain again in exhibiting the rookery as a curiosity, charging twenty-five cents for the trip. Yet in the opinion of the writer it might be well to restrict the growth of the herd by removing some of the males to other localities. Each seal eats not less than ten rock bass or white fish per day, which at a minimum means the destruction of four or five thousand fish from this region daily. Curiously, the best fishing ground about the island is within two hundred feet of the rookery.

On San Clemente Island, twenty miles distant, there are two or three good sized rookeries where the animals are comparatively unmolested and where the schools of fish are so plentiful that the ravages of the sea lions are not felt. The writer after much difficulty visited the sea lion rookery on the island of San Nicolas, eighty miles northwest of Santa Catalina. It lies on the leeward side of the island and was at first in very much the same situation as that of Santa Catalina. Here there were a large number of sea lions, but the single lone herder of the island was doing his best to drive them away, and had partly succeeded by shooting into them with bird shot. His hut was near at hand, and the roaring and barking of the animals, according to his statement, made sleep almost impossible; he also said that the animals were dangerous and would attack any one infringing on their domain.

On the island of Santa Cruz, one hundred miles north of Santa Catalina, three distinct rookeries were visited by the writer, one only being large. On Anacapa Island there is a small rookery, and a large one and several small ones on Santa Rosa. In all, there are probably at least one thousand sea lions and seals on the Southern Californian islands, devouring five thousand pounds of fish per day—a large amount, yet hardly appreciable when the vast food supply is taken into consideration, and it will be some time before the sea lions will have to be destroyed to protect the fisheries.

American Exhibits at Paris.

Space is now being actively assigned to American exhibitors. At present the allotments are tentative, and as soon as possible the permanent allotments will be made and the exhibitors will be notified of how much space they will have and where it will be. While no State buildings will be permitted, any State in the Union that contributes a certain amount to the general fund will have a special room assigned to it in the national building.

Several American attractions are planned. One is to be a gold column of the value of $1,000,000; another will be an American trolley line, and the third will be a pier landing, where Americans will take steamers carrying the American flag for the Vincennes woods.

Mesopotamian Medicine.

Until recently the only evidence as to the state of medical knowledge in ancient Babylonia and Assyria was derived from the list of ailments preserved in the so-called magical cuneiform tablets, which consist of conjurations against various diseases or injuries and the respective demons supposed to be responsible. Now, however, that the study of cuneiform writing has advanced and the number of texts published becomes much greater, documents are coming to light appertaining to medical matters. An American student, Dr. Christopher Johnston, has paid some attention to them, and from his researches the following notes are mainly derived. From Assurbannipal's library have come several letters from physicians, of which four or five are from one name, Arad-nana. One of these is a report to the king of his brother's health. A more interesting relic is a tablet regarding a person who seems to have been suffering from facial erysipelas, though it may have been a case of ophthalmia. The letter, omitting the customary address to royalty, is as follows: "All goes well in regard to that poor fellow whose eyes are diseased. I had applied a dressing covering his face. Yesterday, toward evening, undoing the bandage which held it, I removed the dressing. There was pus upon it the size of the little finger tip. All is well. Let the heart of my lord the king be of good cheer. Within seven or eight days he will be well." Another letter runs thus: "With regard to the patient who has a bleeding from the nose, yesterday there was much hemorrhage. Those dressings are not scientifically applied. They are placed upon the ala of the nose, oppress his breathing, and come off when there is hemorrhage. Let them be placed within the nostrils, then the air will be kept away and the hemorrhage restrained. If it is agreeable to my lord the king, I will go to-morrow and give instructions; meantime let me know how he does." This is evidently an instance of a patient suffering from epistaxis. External compression had been tried and failed, whereas plugging the nares is recommended. The name of another Assyrian physician, Iquisa-Aplu, is known because he was by royal command sent to minister to a famous general named Kudunu, who lay ill at Erech, and he was able to report that he had cured his patient.—Lancet.

The Unveiling of Franklin's Statue.

At last Philadelphia has erected an adequate memorial to the great Benjamin Franklin. The bronze statue which was presented to the city by J. S. Strawbridge was unveiled on June 14. The statue is the work of Sculptor John J. Boyle. The ceremonies were very imposing at the presentation, and were attended by the representatives of several important institutions and societies. Addresses were made by the United States District Attorney James M. Beck and Major Josiah Quincy, of Boston.

Casting Steel in a Vacuum.

Prof. Dewar's success in liquefying hydrogen is bearing fruit. A company has been formed with a capital of $150,000 to determine whether steel can be cast in a vacuum or not. It is hoped, if the plan is successful, that the air bubbles that now cause flaws and weaknesses will be done away with, and that the metal which is produced will be wonderfully homogeneous. The practicability of the process is to be then tested on a large scale.

The Current Supplement.

The current SUPPLEMENT, No. 1225, is of unusual interest both on account of the variety of the articles and their interest. "Boston's Free Municipal Bathing Plan" is a most interesting article by J. A. Stewart, and was referred to editorially in our last issue. It describes a remarkable system of summer and winter baths in use in Boston. "The Physiological Basis of Mental Life" is a paper by Professor Hugo Munsterberg. "Women Inventors" is an article by G. E. Walsh. "Mechanical Influence in Architecture" is a profusely illustrated paper by G. W. Percy. "The Forest Tent Caterpillar," is an illustrated article by Clarence M. Weed. There are a number of other articles on "How to Figure a Chainless Gear," "A New Primary Battery Cell of Large Capacity and High Economy," and "Plan for the Widening of the East Side New York Streets." The usual notes and consular matter are published.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

CIRCUIT AND APPARATUS FOR BRIDGING TELEPHONES.—CHARLES T. MASON, Sumter, S. C. The present invention is a multiple-station telephone-circuit having at each station a normally-closed bridge of the main line, including both bell-ringing magnets of low resistance and the armature-coils of the generator. The bell-magnets are permanently in series with the generator and are adapted to be shunted in signalling. The combination of generator and ringer parts produces in the permanently-bridged circuit at the unemployed stations a high coefficient of self-induction of great impedence to the rapidly-alternating voice-currents, preventing them from short-circuiting or becoming materially weakened by passing through the permanently-bridged circuit of the stations not in use.

TELEGRAPH RECEIVER OR RELAY.—José GALLEGOS, San José de Guatemala, Guatemala. Connected with an electromagnetic core is an eccentric pole-piece mounted to turn about the longitudinal axis of the core. An armature is pivoted about an axis perpendicular to that about which the pole-piece may turn. A circuit-closer is controlled by the movement of the armature. By swinging the eccentric pole-pieces on the axes of the respective cores, not only are the distances of the pole-pieces from each other adjusted; but the distance of the pole-pieces from the armature is varied, thus enabling the leverage of the magnetic force exerted upon the armature to be increased or decreased.

Engineering-Improvements.

STOP-MECHANISM FOR ENGINES.—JOSEPH MATTHEWS, New Bedford, Mass. The stop-mechanism comprises a novel arrangement of a movable cylinder having a diaphragm against the sides of which pressure can be applied from pipes communicating with a main pressure-pipe provided with a number of relief-valves. Should it be desired to stop the engine in case of an accident, one of the relief-valves is turned to close the main pipe to permit water to escape in order to reduce the pressure on one side of the diaphragm. The pressure on the other side will move the cylinder, thus causing the engine valve to close, the parts being held in this position until it is desired to start the engine again.

ROTARY ENGINE.—EDWARD W. COLLINS, Coalville, Iowa. The cylinder of the engine has oppositely-arranged sets of inlet and exhaust ports. The concentric piston rotating in the cylinder is provided with oppositely-arranged, lozenge-shaped piston-heads. Oppositely-arranged sets of spring-pressed abutments extend into the cylinder, and are adapted to be pressed apart or opened by the heads. Sliding cut-off valves control the inlet of the motive agent to the cylinder. Cams on the piston-shaft control the movement of the cut-off valves. A rotatable reversing-valve is provided for each set of cylinder ports.

Mechanical Devices.

LOCK.—OSCAR KATZENBERGER, San Antonio, Tex. Although tumblers are used in this lock, set according to a predetermined combination of figures with letters, the bolt and the latch can be operated from the same knob-spindle when the proper combination has been found. The tumblers may be placed in such combination that they will not act upon the bolt. The lock and latches may be operated from the same spindle. The lock is so constructed that no key is required, or it may be so made that a key can be used to operate the tumblers from the outside of the door, the key in such instance being used instead of a knob.

SCALPER, GRADER, PURIFIER, AND BOLTER FOR FLOUR.—ADAM W. HAAG, Reading, Penn. In the upper portion of the frame of this machine a casing is mounted containing a scalping-screen. A purifying-casing below the first-mentioned casing, communicates therewith and contains a screen. A rotary fan is mounted above the screen to collect the fine screenings. The casings have all a gyratory motion. The flour, in passing from screen to screen and from casing to casing, is very effectually scalped, graded, purified, and bolted, the material too coarse for one screen being passed to another, so that at the end of its course the flour is uniformly refined.

APPARATUS FOR WEAVING.—LÉON DESMARAIS and LOUIS CANAL, Paris, France. The loom has a means for holding the warp-threads and a series of movable heddles or needles for individually raising and lowering the warp-threads, the heddles being carried in the same plane to form a longitudinal row or series. This series of needles is mounted to turn bodily about the axes of rotary cylinders standing at an angle to the plane of the warp threads; whereby the series of needles may be caused to assume a line more or less oblique relatively to the direction of the warp-threads. The combination of the movements of the needles and of the cylinders enables fabrics to be manufactured which, up to the present, could be produced only by the Jacquard mechanism.

PRINTING-PRESS.—JOHN C. MOLLOY, Cincinnati, Ohio. The inventor has endeavored to simplify the construction of job-printing presses. His press is so constructed that a sheet can be simultaneously printed upon opposite sides, and that the feed of the paper from a continuous roll may be regulated to suit any size of sheet. After leaving one form printed upon one side, the sheet is automatically delivered to the second form, which will print upon the opposite side. While the second impression on the first sheet is being made, the first impression on a second sheet is simultaneously made.

WIRE FENCE MACHINE.—MILES H. STARLING, Lowell, Ohio. This machine has a base-frame which supports a main frame. The main frame in turn carries wire supporting and stretching devices, and a post-driving frame having a guide for the wires leading from the stretching devices. The main frame can be adjusted on the base frame whereby the wire stretching and guiding devices may be kept in vertical alinement regardless of the character of the ground-surface.

CENTRIFUGAL MACHINE.—FRANK L. DEPEW, Brookline, Mass. Mounted in a gyrating bearing is a spindle to which a basket is attached. A pulley is provided, the hub of which has a flange held to the basket. Below the basket and above the pulley, a pulley-shield is mounted having a central orifice through which the spindle extends, whereby the spindle can gyrate with the basket. The pulley-shield has an upwardly-extended flange around the opening, running up near the flange on the hub of the pulley.

MECHANICAL DEVICE.—FRANCIS K. GAFF, Hamilton, Ohio. This invention is an improvement in devices having jaws, the object being to provide an arm or jaw of simple construction. The device comprises a bar on which a jaw is movable. A yoke engages around the bar and the movable jaw; and upon the yoke a clamping-head is eccentrically mounted, engaging with a projection upon the movable jaw.

Railway-Appliances.

TIE.—SAMUEL MCELFATRICK, Princeton, Ky. It is the purpose of this invention to provide a tie which holds the rails in place without the use of spikes. The tie comprises two similar sections having vertical members arranged to abut and formed with recesses to receive the rails, and overhanging lugs for engagement with the rail flanges. The vertical members are further provided with elongated slots between the rail-receiving recesses. The slots are adapted to receive a bolt whereby one section may be slidably held upon the other section when the tie is being adjusted to the rails.

TIE-PLATE.—ALEXANDER B. B. HARRIS, Bristol, Tenn. The tie-plate has four spike holes or seats arranged in pairs, one pair of which is offset from the alinement of the other pair. The plate is provided with means for fixedly anchoring it to the tie, so that when the plate is thus anchored to the tie, the rail may be adjusted laterally by drawing the spikes from one pair of holes, shifting the rail laterally, and then driving the spikes in the other or offset pair of holes.

SAFETY RAIL-BRACE.—JOHN A. MCCANN, Quincy, Ill. This combined metal brace and tie is composed of a flat plate having an integral tongue formed of a bent-up portion of metal cut out of the tie. A spike is driven through the opening beneath the tongue and is engaged thereby. The device, it is claimed, maintains a perfect gage, preserves the wooden ties by preventing the rails from cutting into them, and prevents the wear of the rails by the lateral motion of the rolling-stock.

HOSE-COUPLING.—WALTER G. MILLER and WILLIAM L. HARRIS, Lodi, N. Y. It is the purpose of this invention to provide a hose-coupling so arranged that when a train parts, the brakes in the rear section are gradually applied to bring that section slowly to a stop; while the brakes in the forward section remain under the control of the engineer. Each member of the coupling has a valve, means being provided for holding the valves open when the members are locked together, and also means for allowing the valve in the forward portion to close completely, and the valve in the rearward portion to close partially upon separation of the members.

TRIPLE-VALVE.—JAMES H. FARRELL, Harrisburg, Penn. This triple valve for air-brake systems has a slide-valve with a graduating-valve therein, a slide-valve piston, and two auxiliary valves. One auxiliary valve is carried by the slide-valve and the other by the stem of the slide-valve piston. These auxiliary valves control a communication between the train-pipe and the auxiliary reservoir to recharge the latter to full train-pipe pressure at the time the brakes are applied.

RAILWAY-INDICATOR.—MARK MORROW, Percival, Iowa. The indicator is designed to be used to display announcements of changes in ticket-rates, schedules, and the like, at railway-stations. The apparatus is provided with an apron or sheet of canvas attached to and held stretched between parallel rollers, so that it may be wound from one to the other in order to bring into view cards or sheets bearing the announcements.

Miscellaneous Inventions.

SHOE-LACE FASTENING.—MORRIS H. LIPMAN, Manhattan, New York city. The invention provides a shoe that may be quickly and conveniently fastened with a single lace, manipulated with one hand. This ready manipulation is effected by means of a peculiarly-constructed eyelet, serving to receive and hold the end of the lace, thus avoiding the necessity of tying a knot.

TENSION DEVICE FOR TWINE-BINDERS.—OTIS B. LOFSTEDT, Rippey, Iowa. The device is adapted to be carried on the cover of the twine-box of binding-machines, and is designed to regulate the tension of the twine, irrespective of variations of strain and of form. The means by which these ends are attained comprise essentially a grooved wheel around which the twine is passed, the wheel being provided with a spring-pressed brake-bar actuated by a stop on a guide-plate. By means of this device the twine may be drawn from the box with uniform regularity, despite the variations of the strain due to the action of the knotter.

VALVE-REGULATOR.—GEORGE W. LAMBERT, Orange, Mass. This valve-regulator for water-power wheels, has a cylinder in which is mounted a piston connected with the valve to be regulated. A valve controls the inlet of a motive agent to the cylinder and is operated by an electric circuit. A governor operates a circuit closing and opening device. The speed of this governor is regulated by mechanism controlled by the piston.

LET-OFF AND TAKE-UP FOR LOOMS.—AUSTIN J. HANKS, Wilmington, Ohio. To provide a let-off and take-up for looms whereby the warp is properly unwound or fed from the warp-beam, and the woven cloth is wound up on the cloth-beam as fast as required at a uniform tension, is the purpose of the present invention. With the warp and cloth beams is connected a lay provided with an angularly-extending arm rigidly secured thereto and independent of the operating mechanism. A shaft geared with each beam is operated by a pawl-and-ratchet mechanism. Flexible connections between the arm of the lay and the pawl-and-ratchet mechanisms are secured to the free end of the arm of the lay at different points, whereby the beams will be simultaneously and positively operated from the lay, and one beam will be turned a greater distance than the other.

STEERING MECHANISM.—REUBEN H. FREEMAN, Fergus Falls, Minn. Above the vertical shaft of the rudder a horizontal shaft is mounted, having right and left hand screws which receive nuts. With these nuts the rudder is connected. By rotating the horizontal shaft through the medium of a hand-wheel, the nuts will be either brought together or separated, turning the rudder accordingly.

COUPLING AND DRAFT-CUSHIONING DEVICE.—MATHIS FINK, Chaska, Minn. This invention is concerned with means for connecting a traveling power device with the load to be drawn, and provides a simple device which can be readily connected with the source of power (a portable steam-engine or horses attached to a draft-truck) and also with the movable load (a heavy threshing-machine or a hay-loading device). The coupling device is so constructed that a spring-cushion will be introduced between the motive agent, such as a traction engine, and the load which it is to pull, whereby the inertia of the heavy load will be gradually overcome and danger of injuring or breaking the coupling-device be obviated.

INSECTICIDE.—ELIUS F. EICHHOLTZ, Conway, Wash. The insecticide consists of flour of sulfur, carbonate of iron, charcoal, and blue-stone. The compound is placed in a hole bored into the infected tree or plant; and the outer end of the hole is then plugged. The insecticide, it is claimed, will be dissolved by the sap and circulated to all parts of the plant.

PNEUMATIC PROPULSION OF VESSELS.—WALTER CARR, London, England. The vessel to which this system of propulsion is to be applied has air-emission passages terminating in orifices extending across the bow and stern. The air is uniformly distributed across the full breadth of the propelling surface and can be conducted either to the bow or stern-emission orifice for either forward or backward movement, and for steering. There are also provided induction steam and air jet apparatus, steam-generators, means of reducing the steam-pressure at a point between the generator, and a superheater, whereby the heat necessary is supplied to maintain the temperature of the steam or to increase it, notwithstanding the loss of sensible heat incidental to the reduction of pressure.

CHAIR.—WINDSOR O. and EVA K. CAMPBELL, Sulphur Springs, Ark. This chair is a piano-chair comprising a frame in which levers connected with the seat are mounted to rock. A rack is secured at its upper end to the frame, and on the rack a sleeve is mounted to move and has a handle extended from its lower end. By moving the sleeve down on the rack, the outer ends of the levers will be swung upward and the seat will be elevated. By moving the sleeve upon the rack, the seat will be lowered.

LOG-THAWING APPARATUS.—SAMUEL W. BUTTERFIELD, Three Rivers, Canada. The present invention provides an apparatus especially designed to thaw logs used in making paper-pulp. The apparatus has a casing through which the logs pass. A conveyer in the bottom of the casing carries the logs through the casing. Apertured steam-pipes discharge jets of steam upon the logs as they pass through the casing. Self-closing doors retain the heat within the casing after a log has passed.

CARBONATING-MACHINE.—FREDERICK W. ZINGSEM, Brooklyn, New York city. The machine comprises a cylinder in which a mixing chamber is suspended inclosing a propeller-beater which mixes the gas and liquid. Water-supply and gas-pipes lead into the cylinder. In operation the liquid under pressure will run through its pipe and at the same time the gas will be discharged into the water discharged from the water-pipes. The discharged water and gas will strike the beater and cause it to rotate. This rotation will mix the gas and water and throw the solution outward against screens, so that the globules will be finely broken up in order to produce a more thorough mixture.

BELT-HOLDER.—SOLOMON SCHWARZ, Manhattan, New York city. To a strip adapted to be secured to the inside of the belt, wires are secured forming longitudinal

guideways for a holder in the form of a plate provided with a slot, jaws, and a tongue. The holder is slipped longitudinally to engage the button so that the jaws clutch the edge of the button and prevent an up-and-down movement thereof and of the belt. The tongue locks the button and holder together to prevent longitudinal movement of the holder, but allows the holder to move longitudinally with the button on its guideways.

SYRUP-JAR.—JOHN ORMEROD, Brooklyn, New York city. This invention provides a pivoted or drop syrup-jar especially adapted for use on soda-water fountains. The jar is pivoted at its faucet so that it may be moved inward and outward with the least possible exertion. The center of gravity is so placed that when the jars are in an upright position they will not be liable to drop down.

RUBBER COMPOUND. — JOSEPH C. PETMECKY, Austin, Tex. This compound for repairing pneumatic tires consists of pure rubber dissolved in a quick-drying solvent, ground and slightly vulcanized rubber, and cotton fibers, the whole being thoroughly mixed together in proper proportions.

DUMPING-VEHICLE.—THOMAS HILL, Jersey City, N. J. The object of this invention is to protect the vehicle when it comes into contact with the ground from the usual sudden blow. To accomplish this object, the inventor provides a compensating curved upper bearing partially overhanging the lower curved bearing on the vehicle-frame. A rolling-shaft is attached to the body, the ends of which shaft are adapted to revolve or slide in the upwardly-curved bearings, so that while the body is in the act of dumping and changing its center of gravity on the lower curved portion of the frame, it will travel up the overhanging portion above and prevent the possibility of the body's sliding on the lower curved portion of the frame and striking the ground with a sudden jar.

STYLE OF MANUFACTURED TOBACCO.—WILLIAM A. FRETWELL, South Boston, Va. The present invention is designed to enable the tobacco-grower to market his tobacco without the need of a manufacturer's plant and the expense and tedious operation ordinarily incurred. The inventor omits the stemming, the alternate drying and drawing of the moisture of the lumps, and the pressing. Instead, after the tobacco is dipped and flavored, it is at once completely dried while the stems are still intact, and then ordered by steam or dampness. The leaves are then folded and wrapped into neat packages.

JUG CARRIER.—FREDERICK O. BALCH, Neillsville, Wis. The carrier is composed of a band adjustable so that it can be clasped upon jug-necks of different sizes. Hanger-rods are connected with the band, one of the rods having a sliding connection with the band whereby it may be adjusted to correspond with the adjustment of the band.

DEVICE FOR OPENING OR CLOSING GATES.—PATRICK C. and ANTHONY J. GIBBONS, Edina, Mo. The improvements in gates provided by these inventors are concerned chiefly with means for opening and closing a gate at a distance. The means consist primarily in peculiarly-constructed hinges on which the gate is mounted to swing so that its free end may be tilted upward, swung into open position, and subsequently back into closed position.

WINDMILL.—OBED OLSSON, Ord, Neb. This windmill has no rudder. The wheel itself acts as a rudder, being mounted behind the pivot upon which it swings. A peculiar manner of connecting the blades is employed, to swing their edges to the wind. A governor is provided which controls the speed by automatically shifting the vanes. The parts of the mill are all made of iron, so that they will not readily wear out or break, the general construction being also such that any blacksmith can substitute new parts for those which have been worn out or broken.

COMBINATION ARTICLE FOR HOUSEHOLD USE.—CHARLES E. MCLAUGHLIN and ELMER H. WILLIAMS, Kanawha City, W. Va. The combined article comprises a step-ladder, an ironing-board, and a clothes-rack, the various parts being so constructed and arranged that they may be compactly folded together when not in use and easily and quickly arranged in proper position when required for use.

BOWLING-ALLEY LIGHT AND PIN-INDICATOR.—GUSTAVE BURKHARDT, Chicago, Ill. This appliance for reflecting the light and indicating the set of pins on bowling-alleys has its reflector-walls so arranged relatively to the light that the rays can be positively concentrated within a desired radius and the burner held invisible. The reflector has a supplemental portion or triangular pin set face, with light-openings for numerals corresponding in number and arranged with the set of the pins of the alley, so that the bowler can see how every pin is numbered.

APPARATUS FOR CONTROLLING HORSES.—ALEXANDER WHELAN, Washington, D. C. The apparatus consists essentially of a band adapted to inclose the legs of a horse. The band is suspended by lines from a frame forming a support and provided with individual guides for the lines by which the band is suspended. By operating certain mechanism in the carriage or wagon, the band can be lowered to embrace the legs of the horse so that he cannot run away.

Designs.

TERMINAL MEMBER FOR EXERCISING-MACHINES. — EZRA R. GOODRIDGE, Manhattan, New York city. This design provides a unique terminal member for exercising machines, by means of which the cords can be effectively secured in place.

VISIBLE PITCH MUSIC-STAFF.—ALBERT R. PARSONS, Garden City, N. Y. The leading feature of this design consists of variously-spaced parallel lines, certain of which are heavy and continuous, others of which are light and continuous, and still others of which consist of dots. Of the dotted lines, certain are nearer to the full lines above them than to the full lines below them; and certain are nearer to the full lines below them than to the full lines above them.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(7677) M. B. writes: 1. I have made the Wehnelt's electrolytic current breaker described in SCIENTIFIC AMERICAN and SUPPLEMENT of April 15. I used platinum wire of several different sizes (20, 22, 26) with the invariable result that the wire was destroyed, before my coil had been in operation ten minutes; I varied the distance between platinum wire and lead plate and the strength of the acid, with same result. The current used was the 52 volt alternating, and a one ampere fuse in circuit was intact. Can you tell me where the fault lies? A. The platinum wires were probably destroyed by heat, melted. They were too fine for the purpose. 2. What is the insulating material used in the Wydts-Rochefort transformer described in the SUPPLEMENT of January 7, 1899, or what easily procurable oil or fluid will answer the same purpose? A. We do not know the material used as an insulating paste. Paraffine oil would serve the same purpose.

(7678) J. K. asks: 1. In series wound dynamo, is the resistance of field magnet same as that of armature? Is it in shunt wound? A. The field winding of a dynamo is based upon the magnetic flux needed in the machine. 2. How long at one time will ten Bunsen cells connected in series run a motor? A. Till the sulphuric acid has formed all the sulphate of zinc it can; in other words, till the liquid is exhausted. The time required for this depends on the external resistance. 3. How long will the large plunge battery run the simple electric motor described in "Experimental Science"? A. Perhaps 6 hours, but not in a continuous service. 4. I have one Leclanche and three carbon cylinder batteries connected in series. They produce only a very slight current. Are they polarized? If so, how could I remedy them? A. Probably polarized. Rest is the cure.

(7679) W. J. P. asks: 1. What is the best kind of battery to use with a Ruhmkorff coil, in order to get the largest possible spark from coil? A. The potassium bichromate battery is, on the whole, the best primary battery for use with an induction coil. A very convenient form is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 792, price 10 cents. 2. How would you connect two Ruhmkorff coils up to get a combined effect, or can it be done, one coil having a condenser and the other not? I have tried various connections but I could not make it work properly. A. Two coils should be joined in series to use them together, but this is a case where two are not twice as good as one. 3. My coil is insulated by a ½ inch Fullerboard tube between primary and secondary and by paraffined bond paper between each layer of silk C wire of secondary. The edge of the paper between layers being turned up at opposite sides to prevent any possibility of the high tension wires of each layer getting together. With this insulation how large a current could I use without injury to coil? A. You tell nothing about your coil which can help toward an answer to your question. The primary will carry any current which does not overheat it, and that can be guarded against by trying it with the hand. Begin with a small current and increase slowly till you realize maximum effects for the coil.

(7680) M. S. L. asks: What is the best way to exhibit lantern slides (or other transparencies), without a lantern. I mean by placing a large number in a frame with diffusing media between the slides and source of illumination. to use with or without magnifying lenses? A. Transparencies, including lantern slides are exhibited in a frame by diffusing the light through ground glass. If you have not the ground glass, you can make one by careful and patient work, by rubbing a plate of glass with fine sand and a piece of wood. An excellent substitute can be made with starch as follows: Put into 3 fluid ounces of water, 35 grains of starch, and dissolve the starch by boiling. Then let it cool. Pour a suitable quantity of the solution upon the glass, and spread it over the glass. Lay the glass level to dry.

NEW BOOKS, ETC.

STARS AND TELESCOPES. A New Hand Book of Popular Astronomy. By David P. Todd. Boston: Little, Brown & Company. 1899. Pp. 419. 12mo. Illustrated. Price $2.

The volume before us is founded on the ninth edition of Lynn's Celestial Motions. The former book already covered the ground thoroughly. Dr. Todd has however rewritten the book and has made it one of the most interesting and valuable books which has ever appeared on the subject. We note with pleasure the fact that the time-honored and fossilized cuts of astronomical instruments have been entirely displaced by modern illustrations. There are many portraits of varying excellence of execution introduced through the book, adding greatly to its interest. We do not know of any book which is so well adapted to give the average reader and the student such a readable and practical knowledge of astronomy and astronomical methods as this volume, giving a welcome relief from the time-honored and inexpressibly dry methods of presenting the subject that beget a horror of the science.

VON LÖBELL'S JAHRESBERICHTE UEBER DIE VERÄNDERUNGEN UND FORTSCHRITTE IN MILITÄRWESEN. Ueberblick der Entwicklung von 1874–1898. Erste Theil: Berichte über das Heerwesen der Einzelnen Staaten. Berlin: Ernst S. Mittler und Sohn. 1899. Pp. xxxix, 546. Large octavo. Price paper $3.10.

Von Löbell's annual reports have long been recognized as the most authoritative reference-books on military affairs. In the accuracy and trustworthiness of their information they constitute a worthy companion to Brassey's Annuals. The present issue is a "jubilee volume," in which the development of the world's armies during the last twenty-five years has been described. The changes which have taken place during this period, the new methods which have been adopted, and the experience which has been gained in war, have all been carefully noted. This last volume will occupy an important position, for upon it will be based all future reports.

REPORT OF THE UNITED STATES COAST AND GEODETIC SURVEY FOR YEAR 1897. Washington. 1899. Pp. 784. Maps and charts.

This annual report gives an account of the work done in various sections of the country up to June, 1897. Some of the reports give illustrations of recording apparatus for measuring the height and duration of tides, others describe the recent photographic surveying instruments and their use. They are commended for topographical work. Still another report deals with the subject of accurately measuring the Great Salt Lake basin base line and includes photographs of the apparatus used, constructed in such a way as to secure measurements through three differently constructed metal bars, each acting as a check on the other. Differences of temperature are thus equalized and an average is obtained which is quite accurate.

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